GarrettCom®

MAGNUM 6K FAMILY OF SWITCHES

Managed Network Software (MNS)

MNS-6K-SECURE 14.1.4 and MNS-6K 4.1.4

CLI User Guide

Preface

This guide describes how to use the Command Line Interface (CLI) for the Magnum 6K family of switches. For the Web Management Interface please refer to the Web Management Guide.

Some simple guidelines which will be useful for configuring and using the Magnum 6K family of switches -

- If you need information on a specific command in the CLI, type the command name after you type the word "help" (help <*command*>) or just type <command> [Enter].
- If you need information on a specific feature in Web Management Interface, use the online help provided in the interface.
- If you need further information or data sheets on GarrettCom Magnum 6K family of switches, refer to the GarrettCom web links at:

  http://www.garrettcom.com/managed_switches.htm (except MP62 switch shown on the page)

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Printed in the United States of America.

Part #: 84-00131

PK-062808

Table of Contents

List of Figures

Chapter

1

1 – Conventions Followed

Conventions followed in the manual…

To best use this document, please review some of the conventions followed in the manual, including screen captures, interactions and commands with the switch, etc.

Box shows interaction with the switch command line or screen captures from the switch or computer for clarity

Commands typed by a user will be shown in a different color and this font
Switch prompt – shown in Bold font, with a "# or >" at the end. For the document we will use **Magnum6K25#** as the default prompt.

Syntax rules
Optional entries are shown in [square brackets]
Parameter values within are shown in < pointed brackets >
Optional parameter values are shown again in [square brackets]

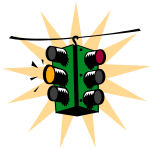
Thus
Syntax command **[parameter1=<value1>[, parameter2=<value2>]] parameter3=<value3|value4>**

In the example above:
Parameter 1 and Parameter 2 are optional values
Parameter 2 can be used optionally only if Parameter 1 is specified
Parameter 3 is mandatory.

Parameter 1 has value1 = IP address
Parameter 2 has value2 = string
Parameter 3 has value3 or value4

Related Topics
Related topics show that GarrettCom strongly recommends reading about those topics. You may choose to skip those if you already have prior detailed knowledge on those subjects.

Tool box – Necessary software and hardware components needed (or recommended to have) as a prerequisite. These include serial ports on a computer, serial cables, TFTP or FTP software, serial terminal emulation software etc.



Caution or take notice – Things to watch out for in case of problems or potential problems. This is also used to draw attention to a special issue, capability or fact.

MNS-6K-SECURE – The functionality described in the related section is available in MNS-6K-SECURE version only. To upgrade from MNS-6K to MNS-6K-SECURE, please contact the GarrettCom Sales or support staff. MNS-6K-SECURE has all the commands MNS-6K has and more. The additional commands in the manual will be shown by the "lock" icon shown here. MNS-6K-SECURE is a licensed feature of GarrettCom Inc. Each switch with MNS-6K is upgraded to MNS-6K-SECURE with the license key provided for that switch from GarrettCom Inc.

Terminology – Whenever the word PC is used it implies a UNIX, Linux, Windows or any other operating system based work station, computer, personal computer, laptop, notebook or any other computing device. Most of the manual uses Windows-XP based examples. While effort has been made to indicate other Operating System interactions, it is best to use a Windows-XP based machine when in doubt.

Supported MNS-6K Version – The documentation reflects features of MNS-6K version 3.4 or later. If your switch is not at the current version, GarrettCom Inc. recommends upgrade to the latest version. Please refer to the GarrettCom Web site for information on upgrading the MNS-6K software on Magnum 6K family of switches.

Product Family – this manual is for all the Magnum 6K family of switches.

Finally, at the end of each chapter, is a list of the commands covered in the chapter as well as a brief synopsis of what they do.

Flow of the User Guide

The manual is designed to guide the user through a sequence of events.

Chapter 1 – this chapter

Chapter 2 is the basic setup as required by the Magnum 6K family of switches. After completing Chapter 2, the configuration can be done using the web interface. Chapter 2 is perhaps the most critical chapter in what needs to be done by the network administrator once the switch is received.

Chapter 3 focuses on operational issues of the switch. This includes time synchronization using the command line or using a time server on the network.

Chapter 4 through Chapter 8 focuses on security and access consideration. Bad passwords trump any security setup, so setup the manager passwords carefully as described in Chapter 2. Chapter 4 describes how to setup port access using MAC address security.

Chapter 5 describes the functionality of a DHCP server and how the switch can be used as a DHCP server

Chapter 6 discusses time synchronization issues and SNTP services

Chapter 7 discusses access consideration and how the access can be secured.

Chapter 8 describes how a RADIUS server can be used for authentication and access.

Chapter 9 essentially is similar to Chapter 7, and talks about using a TACACS+ server for authenticating access to devices on the network.

Chapter 10 talks about port mirroring and preventing broadcast storms. Port mirroring is necessary in a network to reflect traffic from one port onto another port so that the traffic can be captured for protocol analysis or intrusion analysis.

Chapter 11 deals with VLANs. VLANs provide security as well as traffic separation. This chapter shows how VLANs can be setup and managed.

At this stage the network and the switch are secured. It is now critical to make the network more reliable. The User Guide switches gears and talks about STP, RSTP and S-Ring technologies which can be used for making the network reliable. These technologies allow resiliency in a network. **Chapters 12 through Chapter 14** discuss some resiliency techniques.

Chapter 12 shows how STP can be setup and used. Today, RSTP is preferred over STP.

Chapter 13 shows how RSTP is setup and used as well as how RSTP can be used with legacy devices which support STP only.

Chapter 14 focuses on S-Ring™ and setup of S-Ring.

Chapter 15 talks about dual homing and how dual homing can be used to bring resiliency to edge devices.

Chapter 16 describes LACP and how LACP can be used to increase the throughput using 10/100 Mbps ports or in situations where resiliency is needed between switches (trunks).

Once the network is made resilient, the network manager may want to setup prioritization of traffic.

Chapter 17 focuses on Quality of Service (QoS) and other prioritization issues.

Chapters 18 and 19 focus on advanced topics such as IGMP and GVRP.

Chapter 18 focuses on IGMP.

Chapter 19 focuses on GVRP.

Chapter 20 shows how the SNMP parameters can be setup for managing the switch with network management software such as Castle Rock SNMPc™

Chapter 21 includes miscellaneous commands to improve the overall ease of use and other diagnostic information.

Chapter

2

2 – Getting Started

First few simple steps …

This section explains how the GarrettCom Magnum 6K family of switches can be setup using the console port on the switch. Some of the functionality includes setting up the IP address of the switch, securing the switch with a user name and password, setting up VLAN's and more.

Before starting

Before you start, it is recommended to acquire the hardware listed below and be ready with the items listed.

For initial configuration through the serial/console port

1) A female-female null modem cable. This cable is available from GarrettCom Inc. as well as from LAN store (http://www.lanstore.com)
2) Serial port – if your PC does not have a serial port, you may want to invest in a USB to serial converter. This is again available from LAN store or from GarrettCom Inc. Alternately a USB to serial cable can also be used. This cable is also available from LAN store or GarrettCom Inc.
3) A PC (or a workstation/computer) with a terminal emulation program such as HyperTerminal (included with Windows) or Teraterm-pro, minicom or other equivalent software. (Make sure the software supports Xmodem protocol, as you may need this in the future to update the MNS-6K software)
4) Enough disk space to store and retrieve the configuration files as well as copy software files from GarrettCom. We recommend at least 15MB of disk space for this purpose
5) Decide on a manager level account name and password for access security
6) IP address, netmask, default gateway for the switch being configured

As a default, the switch has no IP (Internet Protocol) address and subnet mask. For first time use, the IP address has to be assigned. This can **only** be done by using the console interface provided.

The same procedure can also be used for other configuration changes or updates – e.g. changing the IP address, VLAN assignments and more. Once the IP address is assigned

and a PC is networked to the switch, the switch's command line interface (CLI) can be accessed via telnet. To manage the switch through in-band (networked) access (e.g. telnet, or Web Browser Interface), you should configure the switch with an IP address and subnet mask compatible with your network. You should also change the manager password to control access privileges from the console.

Many other features such as optimizing the switch's performance, traffic engineering and traffic prioritizing, VLAN configuration, and improving network security can be configured through the switch's console interface as well as in-band (networked) access, once the IP address is setup. Besides the IP address, setting up the SNMP parameters allows configuration and monitoring through an SNMP network management station running a network management program (e.g. SNMPc from Castle Rock – available from GarrettCom Inc.)

MNS-6K Software Updates

Magnum switches already have the necessary software loaded on them. If a software upgrade is needed or the MNS-6K software needs to be updated to the current version, please refer to the GarrettCom web site for information on updating the MNS-6K software. The documentation on how to update the MNS-6K is included as an Appendix in this manual.

The Login prompt is shown when the connection to the GarrettCom Magnum 6K Switch is successful and the switch is ready for the configuration commands. Should you get a boot prompt, please contact GarrettCom technical support.

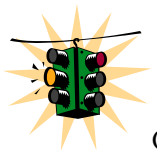
The IP address of the switch is assigned automatically from a DHCP server or a BootP server. If these servers do not exist, the switch will be assigned an IP address which was previously configured or a static IP address of 192.168.1.2 with a netmask of 255.255.255.0 (if that address is not in use). It is recommended that the user uses Secure Web Management (SWM) capabilities built into MNS-6K to setup and manage the switch. Please refer to the SWM user guide for more information.

Console connection

The connection to the console is accessed through the DB-9 RS232 connector on the switch marked on the Magnum 6K family of switches as a console port. This interface provides access to the commands the switch can interpret and is called the Command Line Interface (or CLI). This interface can be accessed by attaching a VT100 compatible terminal or a PC running a terminal emulation program to the console port on the Magnum 6K family of switches.

USB to serial adapters are also available for laptops or computers that do not native serial ports but have access to USB ports.

The interface through the console or the Console Management Interface (or CMI) enables you to reconfigure the switch and to monitor switch status and performance.



Once the switch is configured with an IP address, the Command Line Interface (or CLI) is also accessible using telnet as well as the serial port. Access to the switch can be either through the console interface or remotely over the network.

The Command Line Interface (CLI) enables local or remote unit installation and maintenance. The Magnum 6K family of switches provides a set of system commands which allow effective monitoring, configuration and debugging of the devices on the network.

Console setup

Connect the console port on the switch to the serial port on the computer using the serial cable listed above. The settings for the HyperTerminal software emulating a VT100 are shown in Figure 1 below. Make sure the serial parameters are set as shown (or bps = 38400, data bits=8, parity=none, stop bits=1, flow control=none).

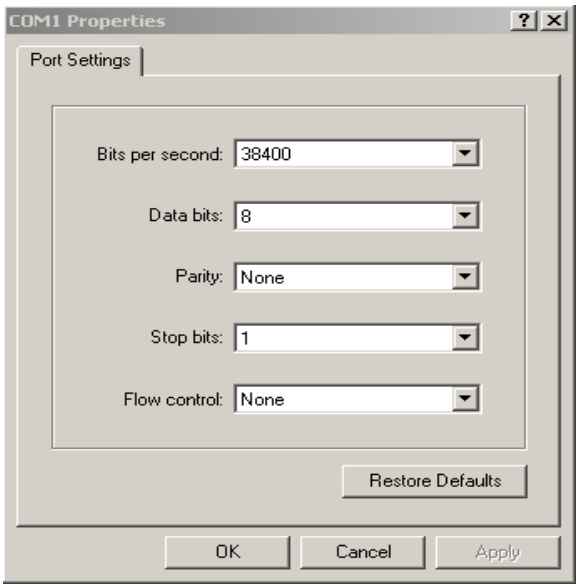


FIGURE 1 - *HyperTerminal screen showing the serial settings*

Console screen

Once the console cable is connected to the PC and the software configured, MNS-6K legal disclaimers and other text scrolls by on the screen.

The switch has three modes of operation – Operator (least privilege), Manager and Configuration. The prompts for the switches change as the switch changes modes from Operator to Manager to Configuration. The prompts are shown in Figure 2 below, with a brief explanation of what the different prompts indicate.

Magnum6K>	*Operator Level – for running operations queries*
Magnum6K#	*Manager Level – for setting and reviewing commands*
Magnum6K##	*Configuration Level – for changing the switch parameter values*

FIGURE 2 - *Prompt indicating the switch model number as well as mode of operation – note the commands to switch between the levels is not shown here.*

The prompt can be changed by the user. See the Chapter on Miscellaneous Commands, sub section Prompt for more details. This manual was documented on a Magnum 6K25 switch, and for clarity, the prompt shown in the manual will be **Magnum6K25**

For additional information on default users, user levels and more, see User Management in this guide.

Logging in for the first time

For the first time, use the default user name and passwords assigned by GarrettCom for the Magnum 6K family of switches. They are:

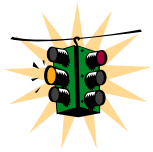
Username – manager	Password – manager
Username – operator	Password – operator

We recommend you login as manager for the first time to set up the IP address as well as change user passwords or create new users.

Setting the IP parameters

To setup the switch, the IP address and other relevant TCP/IP parameters have to be specified. A new GarrettCom Magnum switch looks for a DHCP or a BootP server. If a DHCP or a BootP server is present, the switch will be assigned an IP address from those servers. Failing to find these servers, the IP address is automatically assigned to 192.168.1.2 with a netmask of 255.255.255.0.

Should a situation arise when there are multiple new switches powered up at the same time, there could be a situation of duplicate IP addresses. In this situation, only one Magnum switch will be assigned the IP address of 192.168.1.2 and netmask of 255.255.255.0. The other switches will not be assigned an IP address till the static IP address of 192.168.1.2 is freed up or reassigned.



This situation may not be prevalent in all cases. As the switch tries to determine the mode of operation and its IP address it may assign and release the IP address a number of times. A continuous ping to the switch will show an intermittent response as this happens. This is normal behavior and is shown below. Once the switch assigns itself an IP address the intermittent ping issue is no longer prevalent.

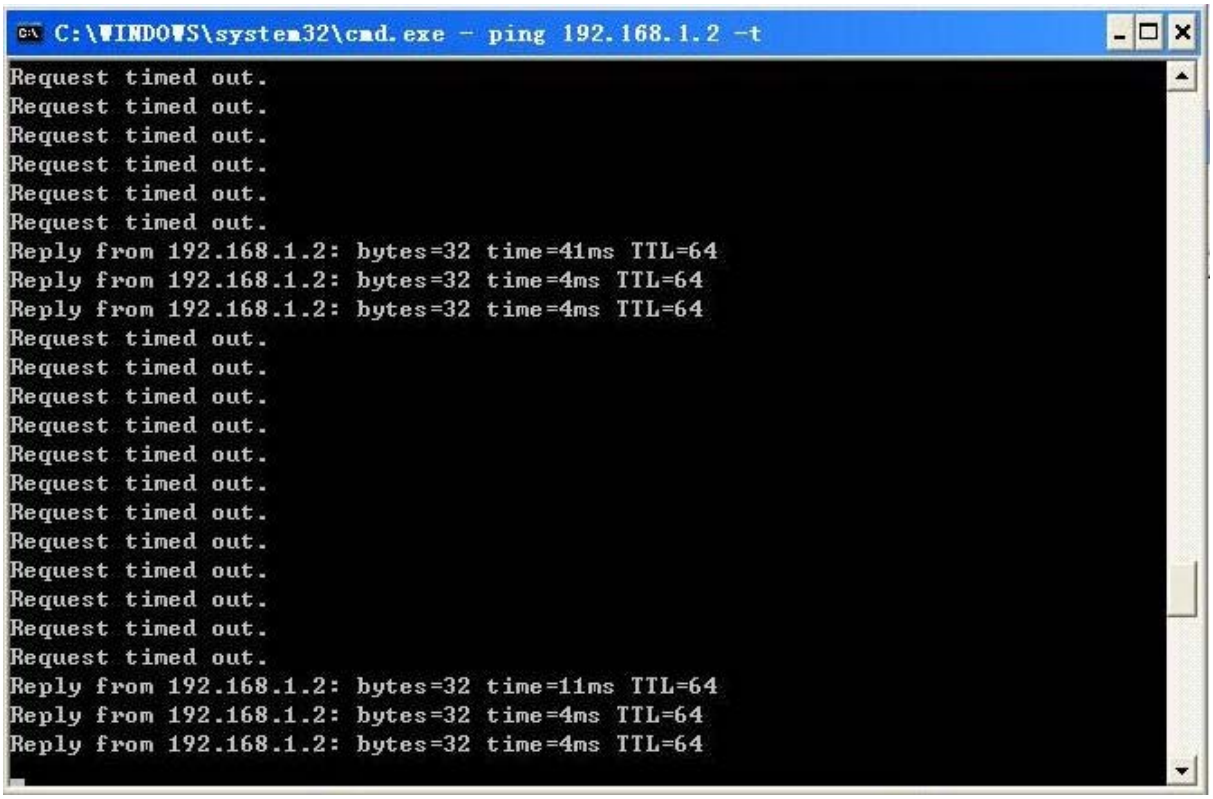


FIGURE 3 – *As the switch tries to determine its mode of operation and its IP address, it may assign and release the IP address a number of times. A continuous ping to the switch will show an intermittent response*

To change the IP address, please ensure that the IP address to be assigned to the switch is known or contact your system/network administrator to get the IP address information. Follow the steps listed below to configure the IP address manually.

- Ensure the power is off
- Follow the steps described above for connecting the console cable and setting the console software

- Power on the switch
- Once the login prompt appears, login as manager using default password (manager)
- Configure the IP address, network mask and default gateway as per the IP addressing scheme for your network
- Set the Manager Password (recommended–refer to next section)
- Save the settings (without saving, the changes made will be lost)
- Power off the switch (or a software reboot as discussed below)
- Power on the switch – login with the new login name and password
- From the PC (or from the switch) ping the IP address specified for the switch to ensure connectivity
- From the switch ping the default gateway specified (ensure you are connected to the network to check for connectivity) to ensure network connectivity

Syntax **ipconfig [ip=<ip-address>] [mask=<subnet-mask>] [dgw=<gateway>] [add|del]**

```
Magnum6K25# ipconfig ip=192.168.1.150 mask=255.255.255.0 dgw=192.168.1.10

Magnum6K25# save
```

FIGURE 4 - *Setting IP address on the switch*

This document assumes the reader is familiar with IP addressing schemes as well as how net mask is used and how default gateways and routers are used in a network.

Reboot gives an opportunity to save the configuration prior to shutdown. For a reboot – simply type in the command "reboot". (Note – even though the passwords are not changed, they can be changed later.)

```
Magnum6K25# reboot
  Proceed on rebooting the switch? [ 'Y' or 'N' ] Y
  Do you wish to save current configuration? [ 'Y' or 'N' ] Y
Magnum6K25#
```

FIGURE 5 - *Rebooting the switch*

MNS-6K forces an answer the prompts with a "Y" or a "N" to prevent accidental keystroke errors and loss of work.

The parameters can be viewed at any time by using the **'show'** command. The show command will be covered in more detail later in various sections throughout the document.

```
Magnum6K25# show setup
```

```
Version              : Magnum 6K25 build 14.1 Jul 28 2008 07:51:45
MAC Address          : 00:20:06:25:b7:e0
IP Address           : 192.168.1.150
Subnet Mask          : 255.255.255.0
Gateway Address      : 192.168.1.10
CLI Mode             : Manager
System Name          : Magnum6K25
System Description   : 25 Port Modular Ethernet Switch
System Contact       : support@garrettcom.com
System Location      : Fremont, CA
System ObjectId      : 1.3.6.1.4.1.553.12.6

Magnum6K25# show sysconfig

 System Name                 : Magnum6K25
 System Contact              : support@garrettcom.com
 System Location             : HO, Fremont, CA
 Boot Mode                   : manual
 Inactivity Timeout(min)     : 10
 Address Age Interval(min)   : 300
 Inbound Telnet Enabled      : Yes
 Web Agent Enabled           : Yes
 Time Zone                   : GMT-08hours:00minutes
 Day Light Time Rule         : USA
 System UpTime               : 36 Days 7 Hours 49 Mins 48 Secs

Magnum6K25#
```

FIGURE 6 - *Viewing the basic setup parameters. You can use 'show setup' or 'show sysconfig' to view setup parameters*

Some of the parameters in the Magnum 6K family of switches are shown above. The list of parameters below indicates some of the key parameters on the switch and the recommendations for changing them (or optionally keeping them the same).

Privilege levels

Two privilege levels are available - **Manager** and **Operator**. Operator is at privilege level 1 and the Manager is at privilege level 2 (the privilege increases with the levels). For example, to set up a user for basic monitoring capabilities use lower number or operator level privilege (Level 1)

The Manager level provides all **Operator level** privileges plus the ability to perform system-level actions and configuration commands. To select this level, enter the '**enable <user-name>'** command at the Operator level prompt and enter the Manager password, when prompted.

Syntax **enable <user-name>**

For example, switching from an Operator level to manager level, using the '**enable'**

command is shown below in Figure 6

```
Magnum6K25> enable manager
Password: *******
Magnum6K25#
```

FIGURE 7 - *Switching users and privilege levels. Note the prompt changes with the new privilege level.*

Operator Privileges

Operator privileges allow views of the current configurations but do not allow changes to the configuration. A ">" character delimits the Operator-level prompt.

Manager Privileges

Manager privileges allow configuration changes. The changes can be done at the manager prompt or for global configuration as well as specific configuration. A "#" character delimits any Manager prompt.

User management

A maximum of five users can be added per switch for MNS-6K and a maximum of twenty users can be added for MNS-6K-SECURE. Users can be added, deleted or changed from a manager level account. There can be more than one manager account, subject to the maximum number of users on the switch.

MNS-6K-SECURE allows a maximum of twenty (20) users. Using MNS-6K-secure you can also configure access to the switch using TACACS+ capabilities, described later on in this manual.

Add User

To add a user, use the command "add" as shown below. The user name has to be a unique name and can be up to 24 characters long. The password is recommended to be at least 8 characters long with a mix of upper case, lower case, numbers and special characters.

Syntax **add user=<name> level=<number>**

```
Magnum6K25# user
Magnum6K25(user)## add user=peter level=2
  Enter User Password:******
  Confirm New Password:******
Magnum6K25(user)##
```

FIGURE 8 - *Adding a user with Manager level privilege*

In this example, user 'peter' was added with Manager privilege.

Delete User

Syntax **delete user=<name>**

```
Magnum6K25(user)##delete user=peter
  Confirm User Deletion(Y/N): Y
  User successfully deleted
Magnum6K25(user)##
```

FIGURE 9 - *Deleting a user*

In this example, user 'peter' was deleted.

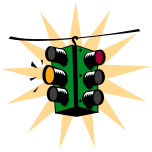
Modify Password

Syntax **passwd user=<name>**

```
Magnum6K25(user)## passwd user=peter
  Enter New Password:******
  Confirm New Password :******
  Password has been modified successfully
Magnum6K25(user)##
```

FIGURE 10 - *Changing the password for a specific user*

In this example, password for 'peter' was modified.



Strong passwords should be 8 to 32 characters long and should include upper case, lower case, numerals as well as special characters such as space, ! @ # $ % ^ & * ( ) _ - + =

Modify the Privilege Level

Syntax **chlevel user=<name> level=<number>**

```
Magnum6K25(user)## chlevel user=peter level=1
 Access Permission Modified
```

```
Magnum6K25(user)##
```

FIGURE 11 - *Changing the privilege levels for a user*

In this example, user 'peter' was modified to Operator privileges.

Modifying Access Privileges

User access allows the network administrators to control as to who has read and write access and for which set of command groups. The command groups are defined as the set of commands within a specific function such as VLAN, Access privileges (as described in this section), user ids and managing those and more. Further, administrators can also control as to what protocols are used by users (e.g. web or SSH but not telnet).To control access privileges, the commands used are

Syntax **useraccess user=<name> service=<telnet|web> <enable|disable>** *- defines the services available to the user to access the device for modifying the configuration*
Syntax **useraccess user=<name> group=<list> type=<read|write> <enable|disable>** *- set read or write access for the command group*
Syntax **useraccess groups** – *displays the current groups*

Where
user=<name> specifies the user id
service=<telnet|web> specifies which service (telnet or web) the user has access to.
<enable|disable> specifies whether the services are allowed or not allowed
group=list – specifies which group the user belongs to
groups – specifies the groups the user has access to. The groups are defined as system, user, access, device, port, vlan, portsec, ps, mirror, lacp, stp, igmp, software, file, debug
type=<read|write> - specifies whether the user has authority to change the configuration or not

```
Magnum6K25# user

Magnum6K25(user)## useraccess

Usage
  useraccess user=<name> service=<telnet|web|acl> <enable|disable>
  useraccess user=<name> group=<list> type=<read|write> <enable|disable>
  useraccess groups

Magnum6K25(user)## add user=peter level=2
Enter User Password     : *****
Confirm New Password : *****
```

```
Magnum6K25(user)## useraccess user=peter group=vlan,user,system type=read enable

 Access rules set for Read Operation.
 Groups: All Command Groups.

ML2400(user)## show users

 Sl#  Username          Access Permissions
 ---  --------          ------------------
  1   manager           Manager
                        Read Access: All Command Groups
                        Write Access: All Command Groups
  2   operator          Operator
                        Read Access: All Command Groups
                        Write Access: All Command Groups
  3   peter             Manager
                        Read Access: All Command Groups
                        Write Access: All Command Groups

Magnum6K25(user)## exit

Magnum6K25#
```

FIGURE 12 – *Creating user access privileges*

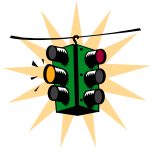
After this command, user Peter will not have read access to the VLAN, system and user groups.

In another example, if the user Peter is not allowed to access the switch using telnet, the access can be blocked using the steps shown below:

```
Magnum6K25# user
Magnum6K25(user)## add user=peter level=2
Enter User Password     :*****
Confirm New Password :*****
Magnum6K25(user)## useraccess user=peter service=telnet disable
  Telnet Access Disabled.
```

FIGURE 13 – *Creating user access privileges*

After this command, user Peter will not have telnet access to the switch. User Peter only has console access or SWM access (or access via SSH for MNS-6K-SECURE)



The user "peter" has to be added before this command can be successfully executed.

Help

Typing the '**help**' command lists the commands you can execute at the current privilege level. For example, typing '**help**' at the Operator level shows

```
Magnum6K25> help

      logout              ping            set
      terminal            telnet          walkmib

      Contextless Commands:

      !                   ?               clear
      enable              exit            help
      show                whoami

      alarm
Magnum6K25>
```

FIGURE 14 - *Help command*

Displaying Help for an Individual Command

Help for any command that is available at the current context level can be viewed by typing **help** followed by enough of the command string to identify the command.

Syntax **help *<command string>***

For example, to list the Help for the '**set time'** command

```
Magnum6K25# help set time
set time          : Sets the device Time

Usage
set time hour=<0-23> min=<0-59> sec=<0-59> [zone=GMT[+/-]hh:mm]
Magnum6K25#
```

FIGURE 15 - *Help for a specific command*

Viewing options for a command

The options for a specific command can be displayed by typing the command and pressing enter.

Syntax **command *<Enter>***

```
Magnum6K25# show <Enter>

Usage
  show active-stp
  show active-snmp
```

```
show active-vlan
show address-table
show age
show alarm
show arp
show auth <config|ports>
show backpressure
show bootmode
--more--
```

FIGURE 16 - *Options for the 'show' command*

Context help

Other ways to display help, specifically, with reference to a command or a set of commands, use the TAB key.

Syntax **<TAB>**

Syntax **<Command string> <TAB>**

Syntax **<First character of the command> <TAB>**

For example, following the syntax listed above, the <TAB> key will list the available commands in the particular privilege level:

```
Magnum6K25> <TAB>
 ?
 alarm
 clear
 enable
 exit
 help
 logout
 ping
 set
 show
 telnet
 terminal
 walkmib
 whoami
Magnum6K25>
```

FIGURE 17 - *Listing commands available (at the operator level)*

OR

```
Magnum6K25> s <TAB>
 set
 show
Magnum6K25>
```

FIGURE 18 - *Listing commands starting with a specific character*

OR

```
Magnum6K25> se<TAB>
  password
  timeout
  vlan
Magnum6K25> set
```

FIGURE 19 - *Listing commands options – note the command was not completed and the TAB key completed the command.*

Exiting

To exit from the CLI interface and terminate the console session use the '**logout**' command. The logout command will prompt you to ensure that the logout was not mistakenly typed.

Syntax **logout**

```
Magnum6K25# logout

Logging out from the current session...[ 'Y' or 'N'] Y

Connection to the host lost
```

FIGURE 20 – *logout command*

Upgrading to MNS-6K-SECURE

MNS-6K-SECURE license can be purchased with the purchase of the switch. In that case a license key will be issues to you with the delivery of the switch. This license key will be needed to upgrade the version.

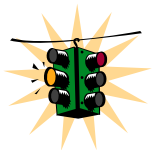
Any MNS-6K switch can be upgraded to MNS-6K-SECURE by purchasing the necessary license key for the switch. Once the license key is obtained, the command to upgrade the switch is

Syntax **authorize secure key=<16character license key>** *- Upgrade MNS-6K to MNS-6K-SECURE*

```
Magnum6K25# authorize secure key=1122334455667788

Security Module Successfully Authorized
Please Save Configuration..

Magnum6K25# save
```

```
Saving current configuration
Configuration saved

Saving current event logs
Event logs saved

Magnum6K25#
```

FIGURE 21 – *Upgrading to MNS-6K-SECURE*



After the license key is entered – please use the save command to save the key in flash memory. It is recommended to preserve the information for future use.

List of commands in this chapter

Syntax **ipconfig [ip=<ip-address>] [mask=<subnet-mask>] [dgw=<gateway>] [add|del]** – *to set IP address on the switch*

Syntax **save** – *save changes made to the configuration*

Syntax **reboot** – *restart the switch – same effect as physically turning off the power*

Syntax **show setup** – *show setup parameters*

Syntax **show config** – *show setup parameters configured*

Syntax **enable <user-name>** - *changing the privilege level*

Syntax **add user=<name> level=<number>** - *adding a user*

Syntax **delete user=<name>** - *deleting a user*

Syntax **passwd user=<name>** - *changing a password for a user*

Syntax **chlevel user=<name> level=<number>** - *changing the user privilege level*

Syntax **help *<command string>*** - *help for a specific command*

Syntax **command *<Enter>*** - *options for a command*

Syntax **<TAB>** *- listing all commands available at the privilege level*

Syntax **<command string> <TAB>** *- options for a command*

Syntax **<first character of the command> <TAB>** *- listing commands starting with the character*

Syntax **logout** *– logout from the CLI session*

Syntax **useraccess user=<name> service=<telnet|web> <enable|disable>** *- defines the services available to the user to access the device for modifying the configuration*

Syntax **useraccess user=<name> group=<list> type=<read|write> <enable|disable>** *- set read or write access for the command group*

Syntax **useraccess groups** *– displays the current groups*

Syntax **authorize secure key=<16character license key>** *- Upgrade MNS-6K to MNS-6K-SECURE*

Chapter

3

3 – IP Address and System Information

First simple steps to follow…

This section explains how the Magnum 6K family of switches can be setup using other automatic methods such as **bootp** and **DHCP**. Besides this, other parameters required for proper operation of the switch in a network are discussed.

IP Addressing

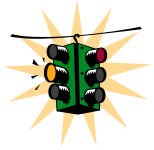
It is assumed that the user has familiarity with IP addresses, classes of IP addresses and related netmask schemes (e.g. class A, Class B and Class C addressing).

Importance of an IP address

Without an IP address, the switch will operate as a standalone Layer 2 switch. Without an IP address, you cannot

- Use the web interface to manage the switch
- Use telnet to access the CLI
- Use any SNMP Network Management software to manage the switch
- Use NTP protocol or an NTP server to synchronize the time on the switch
- Use TFTP or FTP to download the configurations or upload software updates
- Run ping tests to test connectivity

To set the IP address, please refer to the section in Chapter 2 – Setting IP Parameters.



Once the IP address is set, the CLI can be accessed via the telnet programs as well as the console interface. From now on – all commands discussed are accessible from the CLI – irrespective of the access methods – serial port or in band using telnet.

To verify the IP address settings, the **'show ipconfig'** command can be used.

```
Magnum6K25> show ipconfig
IP Address       : 192.168.1.150
Subnet Mask      : 255.255.255.0
Default Gateway : 192.168.1.10
Magnum6K25>
```

FIGURE 22 - *Checking the IP settings*

Besides manually assigning IP addresses, there are other means to assign an IP address automatically. The two most common procedures are using DHCP and bootp.

DHCP and bootp

DHCP is commonly used for setting up addresses for computers, users and other user devices on the network. bootp is the older cousin of DHCP and is used for setting up IP addresses of networking devices such as switches, routers, VoIP phones and more. Both of them can work independent of each other. Both of them are widely used in the industry. It's best to check with your network administrator as to what protocol to use and what the related parameters are. DHCP and bootp require respective services on the network. DHCP and bootp can automatically assign an IP address. It is assumed that the reader knows how to setup the necessary bootp parameters (usually specified on Linux/UNIX systems in /etc/boopttab[1]).

Bootp Database

Bootp keeps a record of systems supported in a database – a simple text file. On most systems, the bootp service is not started as a default and has to be enabled. A sample entry by which the bootp software will look up the database and update the IP address and subnet mask of the switch would be as follows

```
M6k25switch:\
ht=ether:\
ha=002006250065:\
ip=192.168.1.88:\
sm=255.255.255.0:\
gw=192.168.1.1:\
hn:\
vm=rfc1048
```

where
M6k25switch: is a user-defined symbolic name for the switch

[1] Note – on Windows systems – the location of the file will vary depending on which software is being used.

ht: is the "hardware type". For the Magnum 6K family of switches, set this to **ether** (for Ethernet). ***This tag must precede the "ha" tag.***

ha: is the "hardware address". Use the switch's 12-digit MAC address

ip: is the IP address to be assigned to the switch

sm: is the subnet mask of the subnet in which the switch is installed

Configuring Auto/DHCP/Bootp/Manual

By default, the switch is configured for 'auto'. As describer earlier in Chapter 2, in the auto mode, the switch will first look for a DHCP server. If a DHCP server is not found, it will then look for a BootP server. If that server is not found, the switch will first inspect to see if the IP address 192.168.1.2 with a netmask of 255.255.255.0 is free. If the IP address is free, MNS-6K will assign the switch that IP address. If the address is not free, MNS-6K will poll the network for DHCP server then BootP server then check if the IP address 192.68.1.2 is freed up. This mode of assigning the IP address can be changed by using the **'set bootmode'** command.

Syntax **set bootmode type=<dhcp|bootp|manual|auto> [bootimg=<enable|disable>] [bootcfg=[<enable|disable>]** – *assign the boot mode for the switch*

Where

<dhcp|bootp|manual|auto> - where

dhcp – look only for DHCP servers on the network for the IP address. Disable bootp or other modes

bootp – look only for bootp servers on the network. Disable dhcp or other mode

manual – do not set the IP address automatically

auto - the switch will first look for a DHCP server. If a DHCP server is not found, it will then look for a BootP server. If that server is not found, the switch will check to see if the switch had a pre-configured IP address. If it did, the switch would be assigned that IP address. If the switch did not have a pre-configured IP address, it would inspect if the IP address 192.168.1.2 with a netmask of 255.255.255.0 is free. If the IP address is free, MNS-6K will assign the switch that IP address. If the address is not free, MNS-6K will poll the network for DHCP server then BootP server then check if the IP address 192.68.1.2 is freed up

bootimg=<enable|disable> - valid with type=bootp only. This option allows the switch to load the image file from the BootP server. This is useful when a new switch is put on a network and the IT policies are set to load only a specific MNS-6Kimage which is supported and tested by IT personnel.

bootcfg=<enable|disable> - valiad with type=bootp only. This option allows the switch to load the configuration file from the BootP server. This is useful when a new

switch is put on a network and the specific configurations are loaded from a centralized BootP server

```
Magnum6K25# set bootmode type=dhcp
  Save Configuration and Restart System
Magnum6K25# set bootmode type=auto
  Save Configuration and Restart System
Magnum6K25# set bootmode type=bootp bootimg=enable bootcfg=disable
  Network application image download is enabled.
  Network application config download is disabled.
  Save Configuration and Restart System
Magnum6K25#
```

FIGURE 23 - *Changing the boot mode of the switch*

Using Telnet

By default, the telnet client is enabled on the GarrettCom Magnum 6K family of switches. MNS-6K supports five simultaneous sessions on a switch – four telnet sessions and one console session. This allows many users to view, discuss or edit changes to the MNS-6K. This also becomes useful as two remote people want to view the commands and other settings on the switch. The telnet client can be disabled by using the **"telnet disable"** command. Telnet can also be disabled for a specific user by using the **"useraccess"** command discussed in Chapter 2.

Multiple telnet sessions started from the CLI interface or the command line are serviced by MNS-6K in a round robin fashion – i.e. one session after another. If one telnet session started from MNS-6K interface is downloading a file, the other windows will not be serviced till the file transfer is completed.

Syntax **telnet <enable|disable>**

```
Magnum6K25# configure access
Magnum6K25(access)## telnet enable
Access to Telnet already enabled
Magnum6K25(access)## exit
Magnum6K25#
```

FIGURE 24 - *Changing telnet access – note in this case, the enable command was repeated without any effect to the switch*

The **'show console'** command can show the status of the telnet client as well as other console parameters.

```
Magnum6K25# show console
Console/Serial Link
  Inbound Telnet Enabled          : Yes
  Outbound Telnet Enabled         : Yes
  Web Console Enabled             : Yes
  SNMP Enabled                    : Yes
  Terminal Type                   : VT100
  Screen Refresh Interval (sec) : 3
  Baud Rate                       : 38400
  Flow Control                    : None
  Session Inactivity Time (min)   : 10
Magnum6K25#
```

FIGURE 25 - *Reviewing the console parameters – note telnet is enabled*

Users can telnet to a remote host from the Magnum 6K family of switches.

Syntax **telnet <ipaddress> [port=<port number>]**
The default port for telnet is 23.

```
Magnum6K25# show ipconfig
  IP Address          :  192.168.1.11
  Subnet Mask         :  255.255.255.0
  Gateway Address     :  192.168.1.1
Magnum6K25# telnet 192.168.1.1 port=2097
```

FIGURE 26 - *Example of a telnet session*

While MNS-6K times out an idle telnet session, it may be useful to see who is currently connected to the switch. It may also be useful for a person to remotely terminate a telnet session. To facilitate this, MNS-6K supports two commands

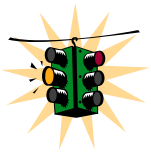
Syntax **show session**

Syntax **kill session id=<session>** *- terminate a telnet session*

```
Magnum6K25# user
Magnum6K25(user)## useraccess user=peter service=telnet enable
  Telnet Access Enabled.
Magnum6K25(user)## exit

Magnum6K25# show session
Current Sessions:

 SL  # Session Id    Connection      User Name     User Mode
  1       1          163.10.10.14     manager      Manager
  2       2          163.11.11.15     peter        Manager
  3       3          163.12.12.16     operator     Operator
Magnum6K25# kill session id=3
  Session Terminated.
Magnum6K25#
```

FIGURE 27 – *managing and viewing multiple telnet sessions*

In the above example, the user with user-id peter is given telnet access (which was disabled earlier in Chapter 2). Then multiple users telnet into the switch. This is shown using the **"show session"** command. The user operator session is then terminated using the **"kill session"** command.



The default port – port 23 is used for telnet.

A maximum of four simultaneous telnet sessions are allowed at any time on the switch. The commands in these telnet windows are executed in a round robin – i.e. if one window takes a long time to finish a command, the other windows may encounter a delay before the command is completed. For example, if one window is executing a file download, the other windows will not be able to execute the command before the file transfer is completed. Another example, if a outbound telnet session is started from the switch (through a telnet window) then the other windows will not be able to execute a command till the telnet session is completed.

Using SSH

SSH is available in MNS-6K-SECURE.

The Telnet, rlogin, rcp, rsh commands have a number of security weakness: all communications are in clear text and no machine authentication takes place. These commands are open to eavesdropping and tcp/ip address spoofing. Secure Shell or SSH is a network protocol that allows data to be exchanged over a secure channel between two computers. SSH uses public/private key RSA authentication to check the identity of communicating peer machines, encryption of all data exchanged (with

strong algorithms such as blowfish, 3DES, IDEA etc.). Encryption provides confidentiality and integrity of data. . The goal of SSH was to replace the earlier rlogin, Telnet and rsh protocols, which did not provide strong authentication or guarantee confidentiality.

In 1995, Tatu Ylönen, a researcher at Helsinki University of Technology, Finland, designed the first version of the protocol (now called SSH-1).

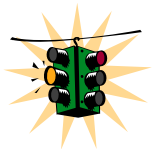
In 1996, a revised version of the protocol, SSH-2, was designed, incompatible with SSH-1. SSH-2 features both security and feature improvements over SSH-1. Better security, for example, comes through Diffie-Hellman key exchange and strong integrity checking via MACs. New features of SSH-2 include the ability to run any number of shell sessions over a single SSH connection. Since SSH-1 has inherent design flaws which make it vulnerable to, e.g., man-in-the-middle attacks, it is now generally considered obsolete and should be avoided by explicitly disabling fallback to SSH-1. While most modern servers and clients support SSH-2, some organizations still use software with no support for SSH-2, and thus SSH-1 cannot always be avoided.

In all versions of SSH, it is important to verify unknown public keys before accepting them as valid. Accepting an attacker's public key as a valid public key has the effect of disclosing the transmitted password and allowing man in the middle attacks.

SSH is most commonly used

- With an SSH client that supports terminal protocols, for remote administration of the SSH server computer via terminal (character-mode) console--can be used as an alternative to a terminal on a headless server;
- In combination with SFTP, as a secure alternative to FTP which can be set up more easily on a small scale without a public key infrastructure and X.509 certificates

While there are other uses for SSH, the two most common uses are described above and are relevant to this manual.



SSH uses port 22 as a default. Note – telnet uses port 23 as a default port.

The SSH-2 protocol has a clean internal architecture (defined in RFC 4251) with well-separated layers. These are:

- The *transport* layer (RFC 4253). This layer handles initial key exchange and server authentication and sets up encryption, compression and integrity verification. It exposes to the upper layer an interface for sending and receiving plaintext packets of up to 32,768 bytes each (more can be allowed by the implementation). The transport layer also arranges for key re-exchange, usually after 1 GB of data has been transferred or after 1 hour has passed, whichever is sooner.

- The *user authentication* layer (RFC 4252). This layer handles client authentication and provides a number of authentication methods. Authentication is *client-driven*, a fact commonly misunderstood by users; when one is prompted for a password, it may be the SSH client prompting, not the server. The server merely responds to client's authentication requests. Widely used user authentication methods include the following:
  - "password": a method for straightforward password authentication, including a facility allowing a password to be changed. This method is not implemented by all programs.
  - "publickey": a method for public key-based authentication, usually supporting at least DSA or RSA keypairs, with other implementations also supporting X.509 certificates.
  - "keyboard-interactive" (RFC 4256): a versatile method where the server sends one or more prompts to enter information and the client displays them and sends back responses keyed-in by the user. Used to provide one-time password authentication such as S/Key or SecurID. Used by some OpenSSH configurations when PAM is the underlying host authentication provider to effectively provide password authentication, sometimes leading to inability to log in with a client that supports just the plain "password" authentication method. This method is not supported.
  - GSSAPI authentication methods which provide an extensible scheme to perform SSH authentication using external mechanisms such as Kerberos 5 or NTLM, providing single sign on capability to SSH sessions. These methods are usually implemented by commercial SSH implementations for use in organizations, though OpenSSH does have a working GSSAPI implementation. This method is not supported.
- The *connection* layer (RFC 4254). This layer defines the concept of channels, channel requests and global requests using which SSH services are provided. A single SSH connection can host multiple channels simultaneously, each transferring data in both directions. Channel requests are used to relay out-of-band channel specific data, such as the changed size of a terminal window or the exit code of a server-side process. The SSH client requests a server-side port to be forwarded using a global request. Standard channel types include:
  - "shell" for terminal shells, SFTP and exec requests (including SCP transfers)
  - "direct-tcpip" for client-to-server forwarded connections
  - "forwarded-tcpip" for server-to-client forwarded connections

The commands for SSH are

Syntax **ssh <enable|disable|keygen>** - *enable or disable the server. Also can be used for generating the key used by ssh*

Syntax **ssh port=<port|default>** - *select a different port number for SSH communication*

Syntax **show ssh** – *display the ssh settings*

```
Magnum6K25# access
```

Magnum6K25 (access)## ssh ?
ssh <enable|disable> : Enables or Disables the SSH
ssh keygen : Generate Security Keys.
ssh port=<port|default> : Set TCP/IP Port

Usage
ssh <enable|disable|keygen>
ssh port=<port|default>

Magnum6K25 (access)## show ssh

SSH is disabled

Magnum6K25 (access)## ssh keygen

SSH Key Generation Started. This will take several minutes to complete.
Upon completion, the keys will be saved to flash memory.

Magnum6K25 (access)## ssh enable

Enabling Access to SSH

ML2400(access)## show ssh

SSH is enabled

Magnum6K25 (access)## telnet disable

ERROR: Connected through telnet.

Magnum6K25 (access)## exit

Magnum6K25# show console

Console/Serial Link

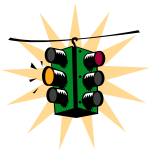
Inbound Telnet Enabled	: Yes
Outbound Telnet Enabled	: Yes
Web Console Enabled	: Yes
SSH Server Enabled	**: Yes**
Modbus Server Enabled	: Yes
SNMP Enabled	: Yes
Terminal Type	: VT100
Screen Refresh Interval (sec)	: 3
Baud Rate	: 38400
Flow Control	: None
Session Inactivity Time (min)	: 10

ML2400# show sysconfig

System Name	: Magnum 6K25
System Contact	: support@garrettcom.com
System Location	: Fremont, CA

```
Boot Mode                    : manual
Inactivity Timeout(min)      : 500
Address Age Interval(min)    : 300
Inbound Telnet Enabled       : Yes
Web Agent Enabled            : Yes
SSH Server enabled           : Yes
Modbus Server Enabled        : Yes
Time Zone                    : GMT-08hours:00minutes
Day Light Time Rule          : None
System UpTime                : 0 Days 0 Hours 2 Mins 31 Secs

ML2400#
```

FIGURE 28 – *setting up ssh – since telnet sends the information in clear text, make sure that telnet is disabled to secure the switch. Do not telnet to the switch to disable telnet. Preferred method is to do that via the console or using SWM. The client access is not shown here. Commonly an application like PUTTY is used to access the switch via ssh. Use the show console command to verify telnet is turned off*



SSH sessions cannot originate from the switch to another device.
A maximum of four SSH session can be active at the same time

Domain Name System (DNS)

DNS functionality is available in MNS-6K-SECURE.

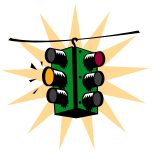
Domain Name System (DNS) associates various sorts of information with domain names or logical computer names. A DNS server provides the necessary services as the "phone book" for the Internet: it translates human-readable computer hostnames, e.g. *google.com or yahoo.com* into the IP addresses that networking equipment needs for communications. Most organizations deploy an internal DNS server so that the support personnel do not have to remember IP address, but instead remember logical names. DNS services on MNS require an interaction with DNS servers. These servers can be defined within MNS-6K using the command

Syntax **set dns [server=<ip>] [domain=<domain name>] <enable|disable|clear>** *- specify a DNS server to look up domain names. The sever IP can be a IPV6 address as well as an IPV4 address*

Syntax **show dns –** *display the DNS settings*

```
Magnum6K25# show dns
  DNS Server Address :  0.0.0.0
  Domain Name        :  Not Set
  DNS Status         :  Disabled.

Magnum6K25# set dns server=192.168.5.254 domain=customer-domain.com
  Domain Name Server Set.

Magnum6K25# show dns
  DNS Server Address :  192.168.5.254
  Domain Name        :  customer-domain.com
  DNS Status         :  Disabled.

Magnum6K25# set dns enable
  DNS enabled.

Magnum6K25# show dns
  DNS Server Address :  192.168.5.254
  Domain Name        :  customer-domain.com
  DNS Status         :  Enabled.

Magnum6K25# ping server
  192.168.5.2 is alive, count 1, time = 20ms

Magnum6K25# set dns clear
  DNS Information Cleared

Magnum6K25# show dns
  DNS Server Address :  0.0.0.0
  Domain Name        :  Not Set
  DNS Status         :  Disabled.

Magnum6K25# ping server
  ERROR: Host Not Found

Magnum6K25#
```

FIGURE 29 – *Use of DNS*



Domain name information as well as the IP address of the Domain server is needed before DNS service is enabled.

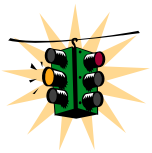
DNS Server IP address can be an IVv6 address

Setting serial port parameters

To be compliant with IT or other policies the console parameters can be changed from the CLI interface. This is best done by setting the IP address and then telnet over to the switch. Once connected using telnet, the serial parameters can be changed. If you are using the serial port, remember to set the VT-100 emulation software properties to match the new settings.

Syntax **set serial [baud=<rate>] [data=<5|6|7|8>] [parity=<none|odd|even>] [stop=<1|1.5|2>] [flowctrl=<none|xonxoff>]**

Where <rate> = standard supported baud rates



Warning – changing these parameters through the serial port will cause loss of connectivity – the parameters of the terminals software (e.g. Hyper Terminal etc.) will also have to be changed to match the new settings.

To see the current settings of the serial port, use the **'show serial'** command.

```
Magnum6K25# show serial
  Baud Rate      : 38400
  Data           : 8
  Parity         : No Parity
  Stop           : 1
  Flow Control   : None
```

FIGURE 30 - *Querying the serial port settings*

System parameters

The system parameters can be queried and changed. To query the system parameters, two commands are used frequently. They are **'show sysconfig'** and **'show setup'**. Both the commands are shown below.

```
Magnum6K25# show setup
  Version              :  Magnum 6K25 build 14.1 Jul 28 2008 07:51:45
  MAC Address          :  00:20:06:25:b7:e0
  IP Address           :  67.109.247.197
  Subnet Mask          :  255.255.255.224
  Gateway Address      :  67.109.247.193
  CLI Mode             :  Manager
  System Name          :  Magnum6K25
  System Description   :  25 Port Modular Ethernet Switch
```

```
System Contact      : support@garrettcom.com
System Location     : Fremont, CA
System ObjectId     : 1.3.6.1.4.1.553.12.6
Magnum6K25#
```

FIGURE 31 - *System parameters using the show setup command. Most parameters here cannot be changed*

```
Magnum6K25# show sysconfig
System Name                 : Magnum6K25
System Contact              : support@garrettcom.com
System Location             : HO, Fremont, CA
Boot Mode                   : manual
Inactivity Timeout(min)     : 10
Address Age Interval(min)   : 300
Inbound Telnet Enabled      : Yes
Web Agent Enabled           : Yes
Time Zone                   : GMT-08hours:00minutes
Day Light Time Rule         : USA
System UpTime               : 7 Days 12 Hours 30 Mins 46 Secs
Magnum6K25#
```

FIGURE 32 - *System parameters using the show sysconfig command. Most parameters here can be changed.*

System variables can be changed. Below is a list of system variables which GarrettCom recommends changing.

System Name: Using a unique name helps you to identify individual devices in a network.

System Contact and System Information: This is helpful for identifying the administrator responsible for the switch and for identifying the locations of individual switches.

To set these variables, change the mode to be SNMP configuration mode from the manager mode.

Syntax **snmp**

Syntax **setvar [sysname|syscontact|syslocation]=<string>** *where string is a character string, maximum 24 characters long*

```
Magnum6K25# snmp
Magnum6K25(snmp)## setvar ?
setvar  : Configures system name, contact or location
Usage:
setvar [sysname|syscontact|syslocation]=<string>
Magnum6K25(snmp)## setvar syslocation=Fremont
  System variable(s) set successfully
Magnum6K25(snmp)## exit
Magnum6K25#
```

FIGURE 33 - *Setting the system name, system location and system contact information*

Date and time

It may be necessary to set the day, time or the time zone manually. This can be done by using the **'set'** command with the necessary date and time options. These are listed below:

Syntax **set timezone GMT=[+ or -] hour=<0-14> min=<0-59>**

Syntax **set date year=<2001-2035> month=<1-12> day=<1-31> [format=<mmddyyyy|ddmmyyyy|yyyymmdd>]**

Syntax **set time hour=<0-23> min=<0-59> sec=<0-59>**

Thus to set the time to be 08:10 am in the -8 hours from GMT (PST or time zone on west coast of USA) and to set the date to be 15 October 2003, the following set of commands are used.

```
Magnum6K25# set time hour=8 min=30 sec=0
 success in setting device time
Magnum6K25# show time
  Time :  8:30:04
Magnum6K25# show timezone
  Timezone :  GMT-08hours:00minutes
Magnum6K25# set date year=2003 month=10 day=15
Success in setting device date
Magnum6K25# show date
  System Date :   Wednesday 10-15-2003 (in mm-dd-yyyy format)
Magnum6K25#
```

FIGURE 34 - *Setting the system date, time and time zone*

Rebooting the switch resets the time to the default. Synchronizing with the time server resets the time. Other relevant date and time commands are:

Syntax **set timeformat format=<12|24>**

Syntax **set daylight country=< country name>**

```
Magnum6K25# set daylight ?
set daylight       : Sets the day light location

Usage
set daylight country=<name>
Magnum6K25# set daylight country=USA

Success in setting daylight savings to the given location/country USA
Magnum6K25# show daylight

 Daylight savings location name :  USA

Magnum6K25#
```

FIGURE 35 - *Setting the system daylight saving time*

See Appendix 3 for additional information on Daylight Savings Time. The lists of countries for the time zone are

Australia, Belgium, Canada, Chile, Cuba, Egypt, France, Finland, Germany, Greece, Iraq, Italy, London, Namibia, Portugal, Russia, Spain, Sweden, Switzerland, Syria, USA

Network time (SNTP Client)

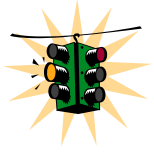
Many networks synchronize the time using a Network time server. The network time server provides time to the different machines using the Simple Network Time Protocol (SNTP). To specify the SNTP server, one has to

1) Set the IP parameters on the switch
2) Define the SNTP parameters

To set the SNTP parameter, enter the SNTP configuration mode from the manager. The **'setsntp, sync, sntp'** commands can then be used to setup the time synchronization automatically from the SNTP server. Note it is not sufficient to setup the SNTP variables. Make sure to setup the synchronization frequency as well as enable SNTP. The list of relevant commands is listed below.

Syntax **setsntp server =<ipaddress> timeout =<1-10> retry =<1-3>**

Syntax **sync [hour=<0-24>] [min=<0-59>] (default = 24 hours)**



The time zone and daylight savings time information have to be set for SNTP server to set the proper time

Syntax **sntp [enable|disable]**

For example, to set the SNTP server to be 204.65.129.201[2] (with a time out of 3 seconds and a number of retries set to 3 times); allowing the synchronization to be ever 5 hours, the following commands are used

```
Magnum6K25# sntp

Magnum6K25(sntp)## setsntp server=204.65.129.201 timeout=3 retry=3

SNTP server is added to SNTP server database
Magnum6K25(sntp)## sync hour=5

Magnum6K25(sntp)## sntp enable
  SNTP is already enabled.

Magnum6K25(sntp)## exit
Magnum6K25(sntp)#
```

Do not forget to enable sntp for time synchronization.

FIGURE 36 - *Setting up SNTP services*

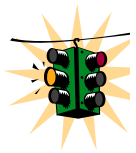
Network time (SNTP Server)

SNTP server feature is available in MNS-6K-SECURE only.

Refer to the chapter on SNTP server in this manual.

Saving and loading configuration

After configuration changes are made, all the changes are automatically registered **but not saved** i.e. the effect of the change is immediate, however, if power fails, the changes are not saved and restored, unless the changed are saved using the save command. It is also a good practice to save the configuration on another server on the network using the tftp or ftp protocols.



er of public NTP servers. Search on the internet using 'NTP Servers' yields the necessary server IP addresses.

To upgrade to MNS-6K 4.x or MNS-6K-SECURE 14.x, make sure the switch is first upgraded to version 3.7 or higher

Once the configuration is saved – the saved configuration can be loaded to restore back the settings. At this time the configuration parameter saved or loaded are not in a human readable format. The commands for saving and loading configurations on the network are:

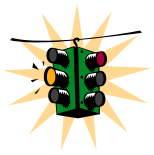
Syntax **saveconf mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>]**

Syntax **loadconf mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>]**

Make sure the machine specified by the IP address has the necessary services running on it. For serial connections, x-modem or other alternative methods can be used. File name in many situations has to be a unique file name as over-writing files is not permitted by most ftp and tftp servers (or services). Only alpha-numeric characters are allowed in the file name – special characters like !@#$%&*(\|){/};[,]" (or other control characters e.g. ^G) are not allowed

```
Magnum6K25# saveconf mode=tftp 192.168.10.1 file=mag6Kmain
  Do you wish to upload the configuration? [ 'Y' or 'N'] Y
```

FIGURE 37 - *Saving the configuration on a tftp server*



The **"saveconf"** and **"loadconf"** commands, while often used often to update new software to the Magnum 6K family of switches, are obsolete and kept for historical reasons. These commands are replaced with the **"ftp"** or **"tftp"** or **"xmodem"** commands listed below.

Before the software is updated, it is advised to save the configurations. The re-loading of the configuration is not usually necessary; however, in certain situations it maybe needed and it is advised to save configurations before a software update. The 'loadconf' command requires a reboot for the new configuration to be active. Without a reboot the older configuration is used by the Magnum 6K family of switches. When Reboot is selected, the user is prompted: 'Reboot Y/N'. Select 'Y', the prompt is then: 'Save Current Configuration?' You must select 'No'.

Along with the ftp command listed below, MNS-6K also supports normal ftp as well as passive ftp. Passive FTP is used by many companies today to work with firewall policies and other security policies set by companies. The commands for setting the type of ftp are:

Syntax **set ftp mode=<normal|passive>** *- set the ftp mode of operation*[3]

[3] FTP uses a set of separate ports for the data stream and command stream. This causes problems in security conscious companies who prefer that the client initiate the file transfer as well as the stream for the commands. To accommodate that, ftp added the capability called "passive ftp" in which the client initiating the connection initiates both the data and command connection request. Most companies prefer passive ftp and GarrettCom MNS-6K provides means to operate in those environments.

Syntax **show ftp**- *display the current ftp operation mode*

With MNS-6K additional capabilities have been added to save and load configurations. The commands are:

Syntax **ftp <get|put|list|del> [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>] [user=<user>] [pass=<password>]** – *upload and download information using ftp command*

Where
<get|put|list|del> - different ftp operations
[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch
[host=<hostname>] [ip=<ipaddress>] [file=<filename>] [user=<user>] [pass=<password>] – parameters associated with ftp server for proper communications with the server

The "**sftp**" command is available in MNS-6K-SECURE version.

Syntax **stftp<get|put| list|del >** **[type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>]** – *upload and download information using sftp (Secure ftp) command*

Where
<get|put| list|del > - different sftp operations – get a file from the server or put the information on the server or list files on the server or delete files from the server
[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch
[host=<hostname>] [ip=<ipaddress>] [file=<filename>] – parameters associated with tftp server for proper communications with the server

Syntax **tftp <get|put> [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>]** – *upload and download information using tftp command*

Where
<get|put> - different tftp operations – get a file from the server or put the information on the server
[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded.

This can also perform the task of exporting a configuration file or uploading a new image to the switch

[host=<hostname>] [ip=<ipaddress>] [file=<filename>] – parameters associated with tftp server for proper communications with the server

Syntax **xmodem <get|put> [type=<app|config|oldconf|script|hosts|log>]** – *upload and download information using xmodem command and console connection*

Where

<get|put> - different xmodem file transfer operations – get a file from the server or put the information on the server

[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch

The details are conceptually explained in the figure below.

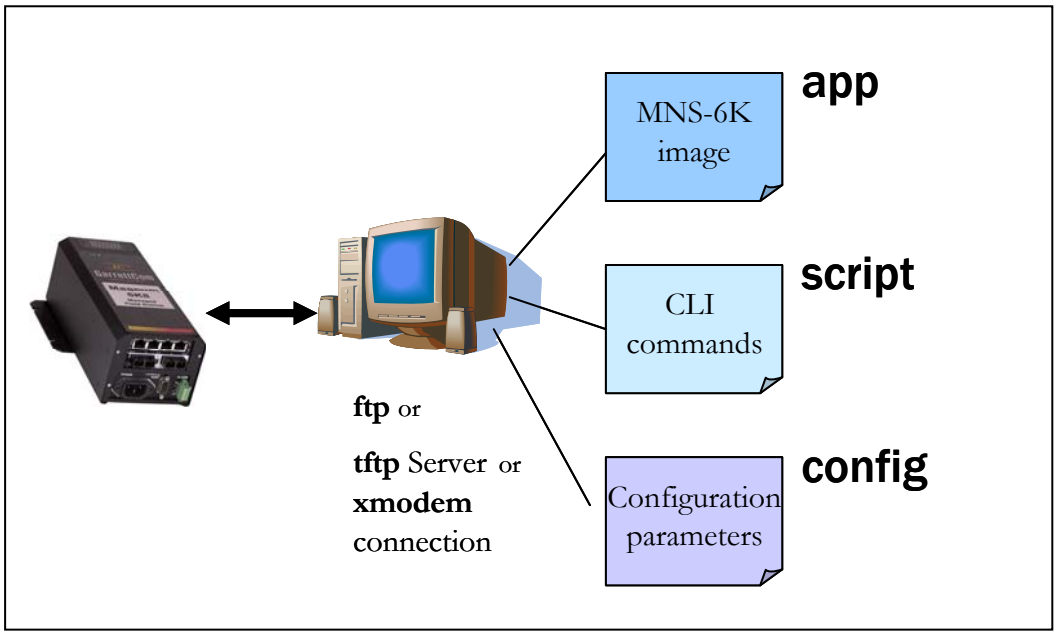
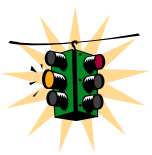


FIGURE 38 – *Based on the sftp, ftp, tftp or xmodem commands – the MNS-6K based switch can upload or download different types of files and images .Other files such as log files, hosts file can also be saved or loaded onto a switch*



Prior to Release 3.2, the configuration was saved only as a binary object (file). With Release 3.2 and beyond, the configuration can be saved in the older format – binary

object or in a newer format as an ASCII (readable) file. The new format is preferred by GarrettCom and GarrettCom recommends all configuration files be saved in the new format. GarrettCom recommends saving the configuration in the old format only if there are multiple Magnum 6K family of switches on the network and they all run different versions of MNS-6K. GarrettCom recommends to upgrade all switches to the most current release of MNS-6K.

Config files

As shown in the figure above, MNS-6K can now use the ftp, tftp or xmodem commands to upload and download information to the server running the proper services. One useful capability provided in MNS-6K is the capability to export the CLI commands (as described in this manual) used to configure the switch. To do that, for example, using the tftp command, the sequence of commands are shown below

```
Magnum6K25# show ftp

 Current FTP Mode: NORMAL
Magnum6K25# set ftp mode=passive

 FTP Set to Passive Mode
Magnum6K25# show ftp

 Current FTP Mode: PASSIVE
Magnum6K25# set ftp mode=normal

 FTP Set to Normal Mode
Magnum6K25# show ftp

 Current FTP Mode: NORMAL
Magnum6K25# ftp put type=config ip=192.168.5.2 file=config
  Do you wish to export configuration file? [ 'Y' or 'N'] Y
  Successfully exported the configuration
Magnum6K25#
```

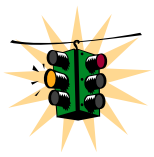
FIGURE 39 – *commands to save the configuration using ftp. Similar options will be specified using tftp etc. When using the ftp command, use the host command discussed later in this section to define the ftp server*

After saving the contents of the saved configuration file are as follows

```
##################################################################
# Copyright (c) 2001-2007 GarrettCom, Inc All rights reserved.
# RESTRICTED RIGHTS
# -------------------------------
# Use, duplication or disclosure is subject to U.S. Government
# restrictions as set forth in Sub-division (b)(3)(ii) of the
# rights in Technical Data and Computer Software clause at
# 52.227-7013.
#
# This file is provided as a sample template to create a backup
```

```
# of Magnum 6K switch configurations. As such, this script
# provides insights into the configuration of Magnum 6K switch's
# settings. GarrettCom recommends that modifications of this
# file and the commands should be verified by the User in a
# test environment prior to use in a "live" production network.
# All modifications are made at the User's own risk and are
# subject to the limitations of the GarrettCom software End User
# License Agreement (EULA). Incorrect usage may result in
# network shutdown. GarrettCom is not liable for incidental or
# consequential damages due to improper use.
##########################################################################

#Magnum 6KQ build 4.0 Dec 16 2007 16:41:37
#Modules: 39 99 86 0
#Slot A: 4 Port TP-MDIX Module
#Slot B: 2 Port Fiber10 Module
#Slot C: 4 Port Fiber100 Module
#Slot D: 1 10/100/1000T 1 Giga SFP-1000
##############################################################
# System Manager - This area configures System related       #
#                  information.                              #
##############################################################
set bootmode type=auto
set timeout=10
access
telnet enable
snmp enable
web enable
ssl enable
exit
##############################################################
# User Accounts - This area configures user accounts for     #
#                 accessing this system.                     #
##############################################################
user
add user=manager level=2 pass=manager
useraccess user=manager service=telnet enable
useraccess user=manager service=web enable
useraccess user=manager service=acl enable
add user=operator level=1 pass=operator
##############################################################

<additional lines deleted for succinct viewing>
```

FIGURE 40 – *Contents of the config file*



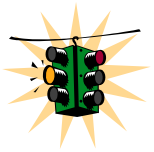
Note 1 – the config file only allows certain portions of the file to be edited by a user. Changing any other part of the file will not allow the file to be loaded as the CRC computed and stored in the file will not be matched. Should you want to edit, edit the

System portion of the file only. GarrettCom recommends editing the "script" file (see below)

Note 2 – File names cannot have special characters such as *#!@$^&* space and control characters.

Script files

Script file is a file containing a set of CLI commands which are used to configure the switch. CLI commands are repeated in the file for clarity, providing guidance to the user editing the file as to what commands can be used for modifying variables used by MNS-6K. The script file does not have a check sum at the end and is used for configuring a large number of switches easily. As with any configuration file that is uploaded, GarrettCom recommends that modifications of this file and the commands should be verified by the User in a test environment prior to use in a "live" production network.



The commands for user access can be encrypted when saving the script file. Please note that when the script file is loaded back to the switch, please make sure the encrypted password is replaced back in clear text. To encrypt and save the config file, use the CLI command

Syntax **set secrets <hide | show>** - *hides or encrypts the user access password. Default is show*

The script file will look familiar as all the commands saved in the script file are described in this manual. A sample of the script file is shown below.

```
######################################################################
# Copyright (c) 2001-2007 GarrettCom, Inc All rights reserved.
# RESTRICTED RIGHTS
# ---------------------------------
# Use, duplication or disclosure is subject to U.S. Government
# restrictions as set forth in Sub-division (b)(3)(ii) of the
# rights in Technical Data and Computer Software clause at
# 52.227-7013.
#
# This file is provided as a sample template to create a backup
# of Magnum 6K switch configurations. As such, this script
# provides insights into the configuration of Magnum 6K switch's
# settings. GarrettCom recommends that modifications of this
# file and the commands should be verified by the User in a
# test environment prior to use in a "live" production network.
# All modifications are made at the User's own risk and are
# subject to the limitations of the GarrettCom software End User
# License Agreement (EULA). Incorrect usage may result in
# network shutdown. GarrettCom is not liable for incidental or
# consequential damages due to improper use.
######################################################################

##############################################################
```

```
# System Manager - This area configures System related                #
#                information.                                         #
#####################################################################

set bootmode type=manual
ipconfig ip=192.168.5.5 mask=0.0.0.0 dgw=0.0.0.0
set timeout=10
access
telnet enable
snmp enable
web=enable
exit
#####################################################################
# User Accounts - This area configures user accounts for              #
#                accessing this system.                               #
#####################################################################

user
add user=manager level=2
passwd user=manager
manager
add user=operator level=1
passwd user=operator
operator
exit

<additional lines deleted for succinct viewing>
```

FIGURE 41 – *Example of Script file. Note all the commands are CLI commands. This script provides insights into the configuration of Magnum MNS-6K settings. GarrettCom recommends that modifications of this file and the commands should be verified by the User in a test environment prior to use in a "live" production network*

To ease the process of uploading and executing a series of commands, the MNS-6K commands are:

Syntax **host <add|edit|del> name=<host-name> [ip=<ipaddress>] [user=<user>] [pass=<password>]** – *create a host entry for accessing host. This is equivalent to creating a host table on many systems. Maximum of 10 such entries are allowed*

Syntax **show host** – *displays the host table entries*

```
Magnum6K25# access
Magnum6K25(access)## host
Usage
  host <add|edit|del> name=<host-name> [ip=<ipaddress>] [user=<user>] [pass=<password>]
Magnum6K25(access)## host add name=server ip=192.168.5.2
  Host added successfully
Magnum6K25(access)## show host
  No    Host        Name            IP Address        User       Password
```

```
=====================================================================
 1              server          192.168.5.2       --        ******
 2              --              --                --        --
 3              --              --                --        --
 4              --              --                --        --
 5              --              --                --        --
 6              --              --                --        --
 7              --              --                --        --
 8              --              --                --        --
 9              --              --                --        --
 10             --              --                --        --
Magnum6K25(access)##
```

FIGURE 42 – *Creating host entries on MNS-6K*

Syntax **more <enable|disable|show>** - *enable or disable the scrolling of lines one page at a time*

Example

```
Magnum6K25# more show
 CLI Display paging enabled.
Magnum6K25# more disable
 CLI Display paging disabled.
Magnum6K25#
```

FIGURE 43 – *Enabling or disabling the pagination*

Displaying configuration

To display the configuration or to view specific modules configured, the **'show config'** command is used as described below.

Syntax **show config [module=<module-name>]**

Where module-name can be

Name	Areas affected
system	IP Configuration, Boot mode, Users settings (e.g. login names, passwords)
event	Event Log and Alarm settings
port	Port settings, Broadcast Protection and QoS settings
bridge	Age time setting
stp	STP, RSTP, S- Ring and LLL settings
ps	Port Security settings
mirror	Port Mirror settings
sntp	SNTP settings
llan	VLAN settings

gvrp	GVRP settings
snmp	SNMP settings
web	Web and SSL/TLS settings
tacacs	TACACS+ settings
auth	802.1x Settings
igmp	IGMP Settings
smtp	SMTP settings

If the module name is not specified the whole configuration is displayed.

```
Magnum6K25# show config
[HARDWARE]
type=Magnum6K25
slotB=8 Port TP Module
#####################################################################
# System Manager - This area configures System related              #
#                  information.                                     #
#####################################################################
[SYSTEM]
***Edit below this line only****
system_name=Main
system_contact=someone@joe.com
system_location=Sunnyvale, CA
boot_mode=manual
system_ip=192.168.1.15
system_subnet=0.0.0.0
system_gateway=192.168.1.11
idle_timeout=10
telnet_access=enable
snmp_access=enable
web_access=enable

--more—
<additional lines deleted for succinct viewing>
```

FIGURE 44 – *'show config'* *command output*

```
Magnum6K25# show config module=snmp
[HARDWARE]
type=Magnum6K25
slotB=8 Port TP Module
#####################################################################
# Network Management - This area configures the SNMPv3              #
#                      agent.                                       #
#####################################################################
[SNMP]
engineid=6K_v3Engine
defreadcomm=public
defwritecomm=private
```

```
deftrapcomm=public
authtrap=disable
com2sec_count=0
group_count=0
view_count=1
view1_name=all
view1_type=included
view1_subtree=.1
view1_mask=ff

--more—
<additional lines deleted for succinct viewing>
```

FIGURE 45 – *displaying specific modules using the* ***'show config'*** *command*

```
Magnum6K25# show config module=snmp,system
[HARDWARE]
type=Magnum6K25
slotB=8 Port TP Module
#########################################################################
# System Manager - This area configures System related                  #
#                information.                                           #
#########################################################################
[SYSTEM]
***Edit below this line only****
system_name=Main
system_contact=someone@joe.com
system_location=Sunnyvale, CA
boot_mode=manual
system_ip=192.168.1.15
system_subnet=0.0.0.0
system_gateway=192.168.1.11
idle_timeout=10
telnet_access=enable
snmp_access=enable
web_access=enable

--more—
<additional lines deleted for succinct viewing>
```

FIGURE 46 – *displaying configuration for different modules. Note – multiple modules can be specified on the command line*

Displaying or hiding passwords

The passwords stored in the script file can be displayed (or stored) in clear text or the password is simply displayed as "password" masking the real password. To do that, use the command

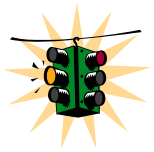
Syntax **set secrets <hide|show>** *- sets the system parameter to display or hide the passwords*

```
Magnum6K25# set secrets hide

Secrets will be hidden.
Magnum6K25# set secrets show

Secrets will be visible.
Magnum6K25#
```

FIGURE 47 – *Hide or display system passwords*

Erasing configuration

To erase the configuration and reset the configurations to factory default, you can use the command **'kill config'.** This command is a "hidden command" i.e. the on-line help and other help functions normally do not display this command. The **'kill config'** command resets everything to the factory default. The reset does not take place till the switch reboots.



It is recommended to save the configuration (using **'saveconf'** command discussed above) before using the **'kill config'** command. The **'kill config'** will also reset the IP address and all other parameters as well unless the save option described below is used.

Syntax **kill config [save=module-name]** – *resets the system configuration. The module-name option does not reset the specific module parameters. The modules are listed below*

The module-names are

Name	Areas affected
system	IP Configuration, Boot mode, Users settings (e.g. login names, passwords)
event	Event Log and Alarm settings
port	Port settings, Broadcast Protection and QoS settings
bridge	Age time setting
stp	STP, RSTP, S- Ring and LLL settings
ps	Port Security settings
mirror	Port Mirror settings
sntp	SNTP settings
vlan	VLAN settings
gvrp	GVRP settings
snmp	SNMP settings
web	Web and SSL/TLS settings
tacacs	TACACS+ settings
auth	802.1x Settings
igmp	IGMP Settings

smtp	SMTP settings

If the module name is not specified the whole configuration is erased.

For example, **'kill config save=system'** preserves the system IP address, netmask and default gateway.

```
Magnum6K25# kill config save=system
Do you want to erase the configuration? [ 'Y' or 'N'] Y
Successfully erased configuration...Please reboot.
```

FIGURE 48 – *Erasing configuration without erasing the IP address*

Once the configuration is erased, please reboot the switch for the changes to take effect.

Displaying Serial Number

To display the serial number of the unit, use the command "show setup" as shown below. The command also displays other information related to the switch.

Syntax **show setup** – *display the setup, serial number, factory code information and more*

```
Magnum 6K25# show setup

Version                    : Magnum 6K25 build 14.1 Jul 28 2008 07:51:45
MAC Address                : 00:20:08:03:05:09
IP Address                 : 192.168.5.5
Subnet Mask                : 255.255.255.0
Gateway Address            : 192.168.5.1
CLI Mode                   : Manager
System Name                : Magnum 6K25
System Description         : 25 Port Modular Ethernet Switch
System Contact             : support@garrettcom.com
System Location            : Fremont, CA
System ObjectId            : 1.3.6.1.4.1.553.12.6
System Seriial No.         : 43576812
Original Factory Config Code : 6K25-8TP

Magnum 6K25#
```

FIGURE 49 – *Display the serial number, factory code and other relevant setup information*

List of commands in this chapter

Syntax **set bootmode type=<dhcp|bootp|manual|auto> [bootimg=<enable|disable>] [bootcfg=[<enable|disable>]** – *assign the boot mode for the switch*

Where

<dhcp|bootp|manual|auto> - where

dhcp – look only for DHCP servers on the network for the IP address. Disable bootp or other modes

bootp – look only for bootp servers on the network. Disable dhcp or other mode

manual – do not set the IP address automatically

auto - the switch will first look for a DHCP server. If a DHCP server is not found, it will then look for a BootP server. If that server is not found, the switch will check to see if the switch had a pre-configured IP address. If it did, the switch would be assigned that IP address. If the switch did not have a pre-configured IP address, it would inspect if the IP address 192.168.1.2 with a netmask of 255.255.255.0 is free. If the IP address is free, MNS-6K will assign the switch that IP address. If the address is not free, MNS-6K will poll the network for DHCP server then BootP server then check if the IP address 192.68.1.2 is freed up

bootimg=<enable|disable> - valiad with type=bootp only. Allows the switch to load the image file from the BootP server. This is useful when a new switch is put on a network and the IT policies are set to load only a specific MNS-6Kimage which is supported and tested by IT personnel.

bootcfg=<enable|disable> - valiad with type=bootp only. Allows the switch to load the configuration file from the BootP server. This is useful when a new switch is put on a network and the specific configurations are loaded from a centralized BootP server

Syntax **telnet <enable|disable>** *- enables or disables telnet sessions*

Syntax **telnet <ipaddress> [port=<port number>]** – *telnet from the switch*

Syntax **ssh <enable|disable|keygen>** *- enable or disable the server. Also can be used for generating the key used by ssh*

Syntax **ssh port=<port|default>** *- select a different port number for SSH communication*

Syntax **show ssh** – *display the ssh settings*

Syntax **set dns [server=<ip>] [domain=<domain name>] <enable|disable|clear>** *- specify a DNS server to look up domain names. The sever IP can be a IPV6 address as well as an IPV4 address*

Syntax **show dns –** *display the DNS settings*

Syntax **set serial [baud=<rate>] [data=<5|6|7|8>] [parity=<none|odd|even>] [stop=<1|1.5|2>] [flowctrl=<none|xonxoff>]** – *sets serial port parameters*

Syntax **snmp** – *enter the snmp configuration mode*

Syntax **setvar [sysname|syscontact|syslocation]=<string>** - *sets the system name, contact and location information*

Syntax **set timezone GMT=[+ or -] hour=<0-14> min=<0-59>** - *sets the timezone*

Syntax **set date year=<2001-2035> month=<1-12> day=<1-31> [format=<mmddyyyy|ddmmyyyy|yyyymmdd>]** – *sets the date and the format in which the date is displayed*

Syntax **set time hour=<0-23> min=<0-59> sec=<0-59>** – *sets the time (as well as the timezone)*

Syntax **set timeformat format=<12|24>** - *sets the display time in the 12/24 hour mode*

Syntax **set daylight country=< country name>** - *sets the daylight saving time*

Syntax **setsntp server = <ipaddress> timeout = <1-10> retry = <1-3>** - *setup the SNTP server*

Syntax **sync [hour=<0-24>] [min=<0-59>]** – *setup the frequency at which the SNTP server is queried*

Syntax **sntp [enable|disable]** – *enables or disables the SNTP services*

Syntax **saveconf mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>]** – *saves the configuration on the network using tftp, ftp or serial protocols*

Syntax **loadconf mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>]** – *loads the previously saved configuration from the network using tftp, ftp or serial protocols*

Syntax **kill config [save=module_name]** – *resets the system configuration. The module_name option does not reset the specific module parameters. The modules are system, event, port, bridge, stp, ps, mirror, sntp, vlan, gvrp and snmp*

Syntax **show session** – *display telnet sessions active on the switch*

Syntax **kill session id=<session>** - *kill a specific telnet session*

Syntax **set ftp mode=<normal|passive>** - *set the ftp mode of operation*

Syntax **show ftp**- *display the current ftp operation mode*

Syntax **ftp <get|put|list|del> [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>] [user=<user>] [pass=<password>]** – *upload and download information using ftp command*

Where

<get|put|list|del> - different ftp operations

[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch

[host=<hostname>] [ip=<ipaddress>] [file=<filename>] [user=<user>] [pass=<password>] – parameters associated with ftp server for proper communications with the server

Syntax **stftp<get|put| list|del > [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>]** – *upload and download information using sftp (Secure ftp) command*

Where

<get|put| list|del > - different sftp operations – get a file from the server or put the information on the server or list files on the server or delete files from the server

[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch

[host=<hostname>] [ip=<ipaddress>] [file=<filename>] – parameters associated with tftp server for proper communications with the server

Syntax **tftp <get|put> [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>]** – *upload and download information using tftp command*

Where

<get|put> - different tftp operations – get a file from the server or put the information on the server

[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch

[host=<hostname>] [ip=<ipaddress>] [file=<filename>] – parameters associated with tftp server for proper communications with the server

Syntax **stftp<get|put| list|del > [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>]** – *upload and download information using sftp (Secure ftp) command*

Syntax **xmodem <get|put> [type=<app|config|oldconf|script|hosts|log>]** – *upload and download information using xmodem command and console connection*

Where

<get|put> - different xmodem file transfer operations – get a file from the server or put the information on the server

[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch

Syntax **host <add|edit|del> name=<host-name> [ip=<ipaddress>] [user=<user>] [pass=<password>]** – *create a host entry for accessing host. This is equivalent to creating a host table on many systems. Maximum of 10 such entries are allowed*

Syntax **show host** – *displays the host table entries*

Syntax **climode <script|console|show>** - *set the interactive CLI mode on (console) or off (script). To see the mode – use the show option*

Syntax **more <enable|disable|show>** - *enable or disable the scrolling of lines one page at a time*

Syntax **show config [module=<module-name>]** – *displays the configuration*

Syntax **set secrets <hide|show>** - *sets the system parameter to display or hide the passwords*

Syntax **kill config [save=module-name]** – *resets the system configuration. The module-name option does not reset the specific module parameters. The modules are listed below*

Other commands

Syntax **configure access** – *sets the access parameters (e.g. disable telnet session)*

Syntax **show ipconfig** – *shows IP parameters set*

Syntax **show console** – *reviews console settings*

Syntax **show serial** – *reviews serial settings*

Syntax **show setup** – *reviews system parameters*

Syntax **show sysconfig** – *reviews settable system parameters*

Syntax **show time** – *shows the system time*

Syntax **show timezone** – *shows the system timezone*

Syntax **show date** – *shows the system date*

Syntax **show uptime** – *shows the amount of time the switch has been operational*

Chapter

4

4 – IPv6

Next generation IP addressing

This section explains how the access to the GarrettCom Magnum MNS-6K can setup using IPv6 instead of IPv4 addressing described earlier. IPv6 provides a much larger address space and is required today by many. IPv6 is available in MNS-6K-SECURE version only.

Assumptions

It is assumed here that the user is familiar with IP addressing schemes and has other supplemental material on IPv6, configuration, routing, setup and other items related to IPv6. This user guide does not dwell or probe those details.

Introduction to IPv6

IPv6 is short for "Internet Protocol Version 6". IPv6 is the "next generation" protocol or IPng and was recommended to the IETF to replace the current version Internet Protocol, IP Version 4 ("IPv4"). IPv6 was recommended by the IPv6 (or IPng) Area Directors of the Internet Engineering Task Force at the Toronto IETF meeting on July 25, 1994 in RFC 1752, The Recommendation for the IP Next Generation Protocol. The recommendation was approved by the Internet Engineering Steering Group and made a proposed standard on November 17, 1994. The core set of IPv6 protocols were made an IETF draft standard on August 10, 1998.

IPv6 is a new version of IP which is designed to be an evolutionary step from IPv4. It is a natural increment to IPv4. It can be installed as a normal software upgrade in internet devices and is interoperable with the current IPv4. Its deployment strategy is designed to not have any dependencies. IPv6 is designed to run well on high performance networks (e.g. Gigabit Ethernet, OC-12, ATM, etc.) and at the same time still be efficient for low bandwidth networks (e.g. wireless). In addition, it provides a platform for new internet functionality that will be required in the near future.

IPv6 includes a transition mechanism which is designed to allow users to adopt and deploy IPv6 in a highly diffuse fashion and to provide direct interoperability between IPv4 and IPv6 hosts. The transition to a new version of the Internet Protocol is normally

incremental, with few or no critical interdependencies. Most of today's internet uses IPv4, which is now nearly twenty years old. IPv4 has been remarkably resilient in spite of its age, but it is beginning to have problems. Most importantly, there is a growing shortage of IPv4 addresses, which are needed by all new machines added to the Internet.

IPv6 fixes a number of problems in IPv4, such as the limited number of available IPv4 addresses. It also adds many improvements to IPv4 in areas such as routing and network auto configuration. IPv6 is expected to gradually replace IPv4, with the two coexisting for a number of years during a transition period.

What's changed in IPV6?

The changes from IPv4 to IPv6 fall primarily into the following categories:

- Expanded Routing and Addressing Capabilities – IPv6 increases the IP address size from 32 bits to 128 bits, to support more levels of addressing hierarchy and a much greater number of addressable nodes, and simpler auto-configuration of addresses. The scalability of multicast routing is improved by adding a "scope" field to multicast addresses.
- A new type of address called a "anycast address" is defined, to identify sets of nodes where a packet sent to an anycast address is delivered to one of the nodes. The use of anycast addresses in the IPv6 source route allows nodes to control the path which their traffic flows.
- Header Format Simplification - Some IPv4 header fields have been dropped or made optional, to reduce the common-case processing cost of packet handling and to keep the bandwidth cost of the IPv6 header as low as possible despite the increased size of the addresses. Even though the IPv6 addresses are four time longer than the IPv4 addresses, the IPv6 header is only twice the size of the IPv4 header.
- Improved Support for Options - Changes in the way IP header options are encoded allows for more efficient forwarding, less stringent limits on the length of options, and greater flexibility for introducing new options in the future.
- Quality-of-Service Capabilities - A new capability is added to enable the labeling of packets belonging to particular traffic "flows" for which the sender requests special handling, such as non-default quality of service or "real- time" service.
- Authentication and Privacy Capabilities - IPv6 includes the definition of extensions which provide support for authentication, data integrity, and confidentiality. This is included as a basic element of IPv6 and will be included in all implementations.

IPv6 Addressing

IPv6 addresses are 128-bits long and are identifiers for individual interfaces and sets of interfaces. IPv6 addresses of all types are assigned to interfaces, not nodes. Since each interface belongs to a single node, any of that node's interfaces' unicast addresses may be

used as an identifier for the node. A single interface may be assigned multiple IPv6 addresses of any type.

There are three types of IPv6 addresses. These are unicast, anycast, and multicast. Unicast addresses identify a single interface. Anycast addresses identify a set of interfaces such that a packet sent to an anycast address will be delivered to one member of the set. Multicast addresses identify a group of interfaces, such that a packet sent to a multicast address is delivered to all of the interfaces in the group. There are no broadcast addresses in IPv6, their function being superseded by multicast addresses.

IPv6 supports addresses which are four times the number of bits as IPv4 addresses (128 vs. 32). This is 4 Billion times 4 Billion times 4 Billion (2^{96}) times the size of the IPv4 address space (2^{32}). This works out to be:

340,282,366,920,938,463,463,374,607,431,768,211,456

This is an extremely large address space. In a theoretical sense this is approximately 665,570,793,348,866,943,898,599 addresses per square meter of the surface of the planet Earth (assuming the earth surface is 511,263,971,197,990 square meters). In the most pessimistic estimate this would provide 1,564 addresses for each square meter of the surface of the planet Earth. The optimistic estimate would allow for 3,911,873,538,269,506,102 addresses for each square meter of the surface of the planet Earth. Approximately fifteen percent of the address space is initially allocated. The remaining 85% is reserved for future use.

The details on the addressing are covered by numerous articles on the WWW as well as other literature and are not covered here.

Configuring IPv6

The commands used for IPv6 are the same as those used for IPv4. Some of the commands will be discussed in more details later. The only exception is the **'ping'** command where there is a special command for IPv6. That commands is **'ping6'** and the syntax is as

Syntax **ping6 <IPv6 address>** *- pings an IPv6 station*

There is also a special command to ping the status of IPv6. That command is

Syntax **show ipv6** *- displays the IPv6 information*

To configure IPv6, the following sequence of commands can be used.

```
Magnum6K25# ipconfig ?
ipconfig :  Configures the system IP address, subnet mask and gateway

Usage
ipconfig [ip=<ipaddress>] [mask=<subnet-mask>] [dgw=<gateway>]
```

```
Magnum6K25# ipconfig ip=fe80::220:6ff:fe25:ed80 mask=ffff:ffff:ffff:ffff::

  Action Parameter Missing. "add" assumed.
  IPv6 Parameters Set.
Magnum6K25# show ipv6

  IPv6 Address : fe80::220:6ff:fe25:ed80 mask : ffff:ffff:ffff:ffff::

Magnum6K25# show ipconfig

  IP Address       :  192.168.5.5
  Subnet Mask      :  255.255.255.0
  Gateway Address  :  192.168.5.1
  IPv6 Address     :  fe80::220:6ff:fe25:ed80 mask : ffff:ffff:ffff:ffff::
  IPv6 Gateway     :  ::

Magnum6K25#
```

FIGURE 50 – *Configuring IPv6*

In addition to the commands listed above, the commands which support IPv6 addressing are

Syntax **ftp <IPv6 address>** - *ftp to an IPv6 station*

Example – **ftp fe80::220:6ff:fe25:ed80**

Syntax **telnet <IPv6 address>** - *telnet to an IPv6 station*

Example – **telnet fe80::220:6ff:fe25:ed80**

Besides, if the end station supports IPv6 addressing (as most Linux and Windows systems do), one can access the switch using the IPv6 addressing as shown in the example below

http://fe80::220:6ff:fe25:ed80

List of commands in this chapter

Syntax **ipconfig [ip=<ip-address>] [mask=<subnet-mask>] [dgw=<gateway>] [add|del]** – *configure and IPv6 address. The add/delete option can be used to add or delete IPv4/IPv6 addresses*

Syntax **show ipconfig** – *display the IP configuration information – including IPv6 address*

Syntax **ping6 <IPv6 address>** - *pings an IPv6 station*

Syntax **show ipv6** - *displays the IPv6 information*

Syntax **ftp <IPv6 address>** - *ftp to an IPv6 station*

Syntax **telnet <IPv6 address>** - *telnet to an IPv6 station*

Chapter

5

5 – DHCP Server

Access to other devices on the network….

This feature is available in MNS-6K-SECURE only. This section explains how DHCP services can be provided for devices on the network. MNS-6K can provide DHCP services.

Network administrators use Dynamic Host Configuration Protocol (DHCP) servers to administer IP addresses and other configuration information to IP devices on the network. This automation provides better control, allows better utilization of IP addresses and finally reduces the maintenance burden. Using DHCP, non active IP address can be reused.

The DHCP client uses the DHCP protocol to obtain IP addresses and other parameters such as the default gateway, subnet mask, and IP addresses of DNS servers from a DHCP server. The DHCP protocol provides a framework for passing configuration information to hosts on a TCP/IP network and is defined by several RFCs. DHCP was a natural evolution from the Bootstrap Protocol (BOOTP), adding the capability of expiration of IP addresses (a lease), automatic allocation and reuse of network addresses and additional configuration options. DHCP captures the behavior of BOOTP relay agents, and DHCP participants can interoperate with BOOTP participants. The DHCP server ensures that all IP addresses are unique[4], e.g., no IP address is assigned to a second client while the first client's assignment is valid (its lease has not expired).

DHCP emerged as a standard protocol in October 1993. DHCP evolved form the older BOOTP protocols, where IP address leases were given for infinite time and as networks evolved, BOOTP faced a restriction as to additional information needed to support different options for proper operation of network devices. Due to the backward compatibility of DHCP, very few networks continue to use only BOOTP. RFC 2131 (March 1997) provides the most commonly implemented DHCP definition. This implementation is widely used and has proven to be interoperable across multiple vendor platforms and operating systems. There are other definitions of the protocol as defined in RFC 3315 (dated July 2003), which describes DHCPv6 (DHCP in an IPv6 environment). New RFC's such as RFC 3396 and RFC 4391 enhance the capabilities of DHCP. Some of these options are not widely implemented.

[4] To keep the unique IP address assignment, network administrators must ensure no manual IP addresses are set and there is only one DHCP server on the network (or on a VLAN.)

As described earlier, the Dynamic Host Configuration Protocol (DHCP) automates the assignment of IP addresses, subnet masks, default gateway, DNS servers and other IP parameters. When a DHCP configured machine boots up or regains connectivity after a power outage or network outage, the DHCP client sends a query requesting necessary information from a DHCP server. The DHCP server listens for such requests and responds back to the client providing information such as the default gateway, the domain name, the DNS servers, other servers such as time servers, extent of the lease and more. The query is typically initiated immediately after booting up and must be completed before the client can initiate IP-based communication with other hosts. The DHCP server replies to the client with an IP address, subnet mask, default gateway, and other requested information such as DNS server, etc.

Modes of Operation

DHCP provides three modes for allocating IP addresses. The best-known mode is dynamic, in which the client is provided a "lease" on an IP address for a period of time. Depending on the stability of the network, this could range from hours (a wireless network at an airport or guest access in an office) to months (for desktops in a lab or in an office). At any time before the lease expires, the DHCP client can request renewal of the lease on the current IP address. A properly-functioning client will use the renewal mechanism to maintain the same IP address throughout its connection to a single network. Maintaining the same IP address is important to correct functioning of higher-layer protocols and applications. However, if the lease actually expires, the client must initiate a new negotiation of an IP address from the server's pool of addresses. As part of the negotiation, it can request its expired IP address, but there are no guarantees that it will get the same IP address. Many ISP's today provide internet connectivity to the home over DSL or cable modems using the DHCP protocol to better utilize the IP space. The DSL router or the cable modem follows the same principles to allocate and reuse the IP address described above.

The second mode for allocation of IP addresses is automatic (also known as DHCP Reservation), in which the address is "permanently" assigned to a client. In this mode an IP address is "reserved" based on the MAC address of the device. When the lease expires, the same IP address is allocated back to the client as long as the MAC address matches. This guarantees the same IP address even after a power outage or a reboot[5]. The network administrators need to change the MAC address should they want to reallocate the IP address to a different device. This reservation method is widely used to allocate IP addresses to a specific zone or a subnet.

The third mode for allocation is manual, in which the address is selected at the client (manually by the user or by some other means) and the DHCP protocol messages are used to inform the server that the address has been allocated. The manual mode is rarely used as it requires human

[5] This is true as long as the DHCP server is accessible and responds to the query

intervention. Most administrators prefer to use static IP addresses (which are allocated out for such purposes) instead of using the manual mode.

Allocating specific IP address for specific networks or VLANs also aids in securing the network. Firewall rules or access rules can be written and designed for specific address ranges, which are allocated out by the DHCP server. Since the allocation is automated and controlled, the network manager can leverage this automation for security automation as well.

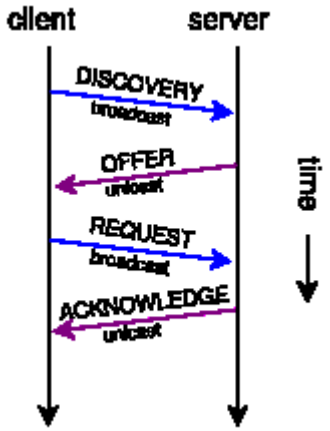
Technical Details

Since the DHCP client evolved from BOOTP, the DHCP protocol uses the same two IANA assigned ports as BOOTP: 67/udp for the server side, and 68/udp for the client side. For DHCP to function across a firewall (including those on PCs or end devices) it is important to "unblock" or "allow" these ports to be used by the device.

DHCP operations fall into four basic operations. These operations are

1) IP lease request
2) IP lease offer
3) IP lease selection and
4) IP lease acknowledgement.

These operations are shown in the figure below.



DHCP Discovery

The client broadcasts on the physical subnet to find available servers. Network administrators can configure a local router to forward DHCP packets to a DHCP server on a different subnet. This client-implementation creates a UDP packet with the broadcast destination of 255.255.255.255 or subnet broadcast address.

A client can also request its last-known IP address. If the client is still in a network where this IP is valid, the server might grant the request. Otherwise, it depends whether the server is set up as authoritative or not. An authoritative server will deny the request, making the client ask for a new IP immediately. A non-authoritative server simply ignores the request, leading to an implementation dependent time out for the client to give up on the request and ask for a new IP.

DHCP Offers

When a DHCP server receives an IP lease request from a client, it extends an IP lease offer. This is done by reserving an IP address for the client and sending a DHCPOFFER message across the network to the client. This message contains the client's MAC address, followed by the IP address that the server is offering, the subnet mask, the lease duration, and the IP address of the DHCP server making the offer. The server determines the configuration, based on the client's hardware address as specified in the CHADDR field. The server specifies the IP address in the YIADDR field.

DHCP Request

When the client PC receives an IP lease offer, it must tell all the other DHCP servers that it has accepted an offer. To do this, the client broadcasts a DHCPREQUEST message containing the IP address of the server that made the offer. When the other DHCP servers receive this message, they withdraw any offers that they might have made to the client. They then return the address that they had reserved for the client back to the pool of valid addresses that they can offer to another computer. Any number of DHCP servers can respond to an IP lease request, but the client can only accept one offer per network interface card.

DHCP Acknowledgement

When the DHCP server receives the DHCPREQUEST message from the client, it initiates the final phase of the configuration process. This acknowledgement phase involves sending a DHCPACK packet to the client. This packet includes the lease duration and any other configuration information that the client might have requested. At this point, the TCP/IP configuration process is complete. The server acknowledges the request and sends the

acknowledgement to the client. The system as a whole expects the client to configure its network interface with the supplied options.

DHCP Information

The client sends a request to the DHCP server: either to request more information than the server sent with the original DHCP ACK; or to repeat data for a particular application. Such queries do not cause the DHCP server to refresh the IP expiry time in its database.

DHCP Release

The client sends a request to the DHCP server to release the DHCP and the client releases its IP address as well. The DHCP protocol does not define the sending of DHCP Release as mandatory, as the release of IP address is up to the client.

Client Configuration

A DHCP server can provide optional configuration parameters to the client. RFC 2132 defines the available DHCP options, which are summarized here. Defined by Internet Assigned Numbers Authority (IANA) - DHCP and BOOTP PARAMETERS

MNS-6K-SECURE Implementation

MNS-6K implements the DHCP server for MNS-6K-SECURE. The commands to implement the DHCP server are

Syntax - **dhcpsrv <start|stop>** *- start or stop the DHCP server. By default, the server is off*

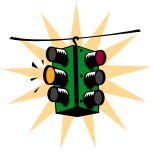
Syntax - **config startip=<start ip> endip=<endip> mask=<mask> [dns=<dns1, dns2, …dns10>] [gateway=<gateway>] [leasetime=<lease time(1..10 hours)>]** *– configure the DHCP lease request parameters such as starting IP address, ending IP address, DNS server parameters, default gateway IP address and lease time*

Syntax – **addlease ip=<ip> mac=<mac> [leasetime=<lease time (1..10)>]** *– add a specific host with a specific IP address*

Syntax - **reserve-ip ip=<ip> [mac=<mac>]** - *reserve a specific IP address for a device*

Syntax - **clear-reserveip ip=<ip>** - *clear the reverse IP assigned*

Syntax - **show dhcpsrv <config|status|leases>** - *display the DHCP server configuration, leases as well as status*



DHCP Services are available for the default VLAN only. If DHCP services are needed for other VLANs or routing is needed for VLANs, GarretttCom recommends using the MNS-DX product family for such purposes.

```
Magnum6K25# dhcpserver

Magnum6K25(dhcpserver)## config ?
config : To set the starting ip and ending ip of DHCP server lease pool and leas
e time

Usage
config startip=<start ip> endip=<end ip> mask=<mask> [dns=<dns>] [gateway=<gatew
ay>] [leasetime=<lease time(1..10 hours)>]

Magnum6K25(dhcpserver)## config startip=192.168.10.100 endip=192.168.10.200
        mask=255.255.255.0 gateway=192.168.10.254 dns=172.168.15.1 leasetime=8

Magnum6K25(dhcpserver)## dhcpsrv start

DHCP Server Started Successfully

Magnum6K25(dhcpserver)## show dhcpsrv status

DHCP SERVER RUNNING
Magnum6K25(dhcpserver)## show dhcpsrv leases

 DHCP Server Leases
 IP              MAC               Expires(sec)
 ------------------------------------------------
 192.168.10.100   00:20:06:a1:12:c3  Never
 192.168.10.101   00:20:06:a1:12:25  Expired
Magnum6K25(dhcpserver)## show dhcpsrv config

  DHCP Server Configuration
  -------------------------
 StartIP              : 192.168.10.100
 EndIP                : 192.168.10.200
 Mask                 : 255.255.255.0
 DNS Server           : 172.168.15.1
```

```
 Gateway              : 192.168.10.1
 Lease time           : 8 Hours
Magnum6K25(dhcpserver)## dhcpsrv stop

 The Server takes few seconds to Stop.....................................
Magnum6K25(dhcpserver)## exit

Magnum6K25#
```

FIGURE 51 – *Setting up DHCP Server on MNS-6K-SECURE*

List of commands in this chapter

Syntax - **dhcpsrv <start|stop>** *- start or stop the DHCP server. By default, the server is off*

Syntax - **config startip=<start ip> endip=<endip> mask=<mask> [dns=<dns1, dns2,..dns10>] [gateway=<gateway>] [leasetime=<lease time(1..10 hours)>]** *– configure the DHCP lease request parameters such as starting IP address, ending IP address, DNS server parameters, default gateway IP address and lease time*

Syntax – **addlease ip=<ip> mac=<mac> [leasetime=<lease time (1..10)>]** *– add a specific host with a specific IP address*

Syntax - **reserve-ip ip=<ip> [mac=<mac>]** *- reserve a specific IP address for a device*

Syntax - **clear-reserveip ip=<ip>** *- clear the reverse IP assigned*

Syntax - **show dhcpsrv <config|status|leases>** *- display the DHCP server configuration, leases as well as status*

Chapter

6

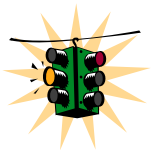
6 – SNTP Server

Synchronizing the time….

After discussing how to setup an SNTP client in an earlier chapter, it is important to figure out where the synchronizing server or the clock synchronization information comes from. This chapter discusses the details on how a Magnum switch can be setup as a SNTP server.

SNTP - prerequisites

It is assumed here that the user is familiar with issues on why time synchronization is needed between systems on a network. If not, sooner or later the importance of having the same time for logs, software updates, synchronized or scheduled restarts etc. will be realized by the system administrator as well as the network administrator. If the user is not familiar with the importance of time synchronization it is strongly recommended to read up various articles available on the Internet on this topic.



SNTP Server is available only on MNS-6K-SECURE

Not all models of the GarrettCom 6K family of switches support SNTP server as this functionality requires a clock that needs to be accurate. While all devices can be SNTP clients, a select set of devices can be SNTP servers.

Background

The standard timescale used by most nations of the world is Coordinated Universal Time (UTC), which is based on the Earth's rotation about its axis. Time Zone offsets are typically set to the UTC, including GMT, which is an approximation of UTC.

International Atomic Time (TAI, from the French name Temps Atomique International) is a high-precision atomic time standard that tracks proper time on Earth's period. TAI is the principal realization of Terrestrial Time, and the basis for Coordinated Universal Time (UTC) which is used for civil timekeeping all over the Earth's surface. The Gregorian calendar, which is based on the Earth's rotation about the Sun, uses the UTC to designate things such as time, date, month, year etc. The UTC timescale is modified with respect to International Atomic

Time or Temps Atomique International (TAI) by inserting leap seconds at intervals of about 18 months. UTC time is disseminated by various means, including radio and satellite navigation systems, telephone modems and portable clocks.

In 1981 the time synchronization technology was documented in the now historic Internet Engineering Note series as IEN-173. The first specification of a public protocol developed from it appeared in RFC-778. The first deployment of the technology in a local network was as an integral function of the Hello routing protocol documented in RFC-891, which survived for many years in a network prototyping and test bed operating system called the Fuzzball. There was considerable discussion during 1989 about the newly announced Digital Time Synchronization Ser-vice (DTSS), which was adopted for the Enterprise network. The DTSS and NTP communities had much the same goals, but somewhat different strategies for achieving them. One problem with DTSS, as viewed by the NTP community, was a possibly serious loss of accuracy, since the DTSS design did not discipline the clock frequency. The problem with the NTP design, as viewed from the DTSS community, was the lack of formal correctness principles in the design process.

Simple Network Protocol (SNTP) is described in RFC-1769 as well as in RFC-2030. SNTP is compatible with NTP as implemented for the IPv4, IPv6 and OSI protocol stacks. SNTP has been used in several standalone NTP servers integrated with GPS receivers.

The article from NIST http://tf.nist.gov/timefreq/service/pdf/computertime.pdf provides details on time synchronization services as well as ports time synchronization services need to communicate on. http://physics.nist.gov/GenInt/Time/time.html provides a walk through the history of time and time synchronization on the NIST site. There are many other interesting articles available on Internet.

Stratum clocks

NTP uses a hierarchical system of "clock strata". The stratum levels define the distance from the reference clock and exist to prevent cycles in the hierarchy. (Note that this is different from the notion of clock strata used in telecommunications systems.)

Stratum 0

These are devices such as atomic (cesium, rubidium) clocks, GPS clocks or other radio clocks. Stratum-0 devices are not attached to the network; instead they are locally connected to computers (e.g. via an RS-232 connection.) The atomic clock at the NIST Denver facility is an example of the Stratum 0 clock.

Stratum 1

These are computers attached to Stratum 0 devices. Normally they act as time servers for timing requests from Stratum 2 servers via NTP. These computers are also referred to as time servers. Time servers from NIST and USNO are examples of Stratum 1 servers.

Stratum 2

These are computers that send NTP requests to Stratum 1 servers. Normally a Stratum 2 computer will reference a number of Stratum 1 servers and use the NTP algorithm to gather the best data sample, dropping any Stratum 1 servers that seem obviously wrong.

Stratum 2 devices will peer with other Stratum 2 devices to provide more stable and robust time for all devices in the peer group. Stratum 2 devices normally act as servers for Stratum 3 NTP requests.

Stratum 3

These devices employ exactly the same NTP functions of peering and data sampling as Stratum 2, and can themselves act as servers for lower strata, potentially up to 16 levels. NTP (depending on what version of NTP protocol in use) supports up to 256 strata.

This is summarized in the figure below.

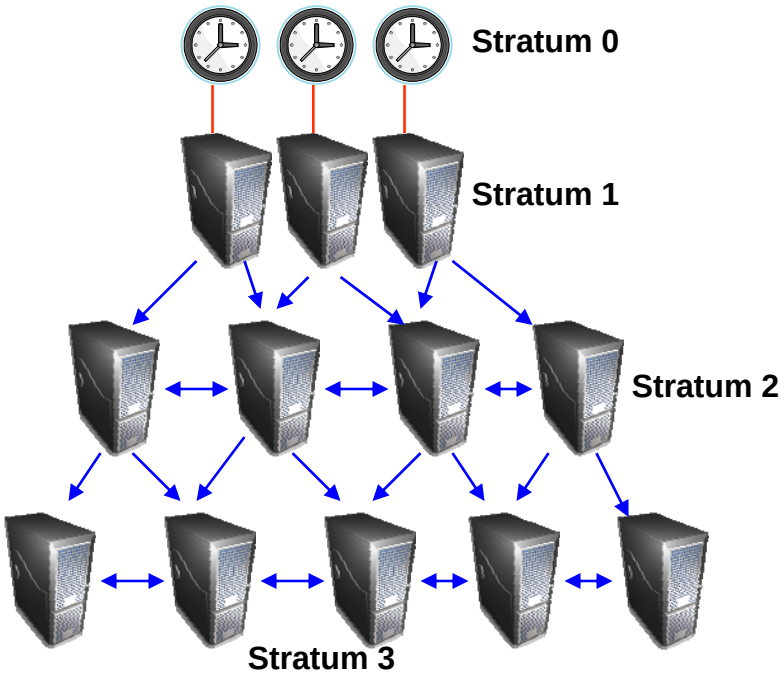
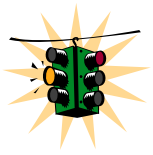


FIGURE 52 – *Different Stratum NTP servers*

Special purpose receivers are available for many time-dissemination services, including the Global Position System (GPS) and other services operated by various national governments. For reasons of cost and convenience, it is not possible to equip every computer with one of these receivers. However, it is possible to equip some number of computers, routers or switches acting as primary time servers to synchronize a much larger number of secondary servers and clients connected by a common network.



Several Magnum 6K switches with MNS-6K-SECURE can act as Stratum 2 or Stratum 3 servers. Make sure the SNTP client is configured to synchronize information from other Stratum 1 or Stratum 2 servers.

www.ntp.org provides a list of NTP servers available by continent/country. For example, as of this writing, for North America, north-america.pool.ntp.org has over 500 NTP servers.

MNS-6K-SECURE Implementation

Syntax **sntpserver** – *enter the SNTP Server configuration mode*

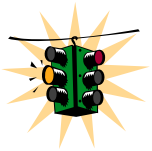
Syntax **sntpsrv <start|stop>** - *Start or stop the SNTP Services*

Syntax **show sntpsrv** – *display the status of SNTP server*

The usage of the commands are shown below.

```
Magnum6K25# sntpserver
Magnum6K25(sntpserver)##
Magnum6K25(sntpserver)## sntpsrv ?
sntpserver : Starts or Stops

Usage
sntpsrv <start|stop>

Groups: system
Magnum6K25(sntpserver)## show sntpsrv

 SNTP SERVER Running
Magnum6K25(sntpserver)## sntpsrv stop

 Stopping SNTP Server...
 SNTP Server Stopped.
Magnum6K25(sntpserver)## show sntpsrv

 SNTP SERVER Stopped
Magnum6K25(sntpserver)## sntpsrv start

SNTP server started.
Magnum6K25(sntpserver)## show sntpsrv

 SNTP SERVER Running
Magnum6K25(sntpserver)## exit
Magnum6K25#
```

FIGURE 53 – *Using the SNTP commands*



A Tech Brief on the GarrettCom web site describes how this capability can be used to create time servers in a network. To review this tech brief, please go to www.garrettcom.com and click on Support → Software Support and look for Tech Briefs.

List of commands in this chapter

Syntax **sntpserver** – *enter the SNTP Server configuration mode*

Syntax **sntpsrv <start|stop>** - *Start or stop the SNTP Services*

Syntax **show sntpsrv** – *display the status of SNTP server*

Chapter

7

7 – Access Considerations

Securing the switch access….

This section explains how the access to the GarrettCom Magnum MNS-6K can be secured. Further security considerations are also covered such as securing access by IP address or MAC address.

Securing access

It is assumed here that the user is familiar with issues concerning security as well as securing access for users and computers on a network. Secure access on a network can be provided by authenticating against an allowed MAC address as well as IP address.

Passwords

Magnum 6K family of switches comes with a factory default password for the manager as well as the operator account. Passwords can be changed from the user id by using the command **'set password'** command.

Syntax **set password**

Example

```
Magnum6K25# set password
Enter New Password :*******
Confirm New Password :*******
Password has been modified successfully
Magnum6K25#
```

FIGURE 54 – *Changing password for a given account*

Other details on managing users and the passwords are covered in Chapter 2, User Management.

Port Security

The port security feature can be used to block computers from accessing the network by requiring the port to validate the MAC address against a known list of MAC addresses. This port security feature is provided on an Ethernet, Fast Ethernet, or Gigabit Ethernet port. In case of a security violation, the port can be configured to go into the **disable mode** or **drop mode**. The disable mode disables the port, not allowing any traffic to pass through. The drop mode allows the port to remain enabled during a security violation and drop only packets that are coming in from insecure hosts. This is useful when there are other network devices connected to the Magnum 6K family of switches. If there is an insecure access on the secondary device, the Magnum 6K family of switches allows the authorized users to continue to access the network; the unauthorized packets are dropped preventing access to the network.

Network security

Network security hinges on the ability to allow or deny access to network resources. The access control aspect of secure network services involves allowing or disallowing traffic based on information contained in packets, such as the IP address, MAC address, or other content. Planning for access is a key architecture and design consideration. For example, which ports are configured for port security? Normally rooms with public access e.g. lobby, conference rooms etc. should be configured with port security. Once that is decided, the next few decisions are – who are the authorized and unauthorized users? What action should be taken against authorized as well as unauthorized users? How are the users identified as authorized or unauthorized?

Configuring Port Security

Login as a level 2 user or as a manager to configure port security. Once logged in, get to the port-security configuration level to setup and configure port security.

Syntax **port-security**

For example

```
Magnum6K25# configure port-security

Magnum6K25(port-security)##
```

FIGURE 55 – *Port security configuration mode*

Alternately, the following commands can also be used to enter the port-security configuration mode:

```
Magnum6K25# port-security
```

```
Magnum6K25(port-security)##
```

FIGURE 56 – *Port security configuration mode*

From the port-security configuration mode, the switch can be configured to:
1) Auto-learn the MAC addresses
2) Specify individual MAC addresses to allow access to the network
3) Validate or change the settings

The commands for doing the above actions are:

Syntax **allow mac=<address|list|range> port=<num|list|range>**

Syntax **learn port=<number-list> <enable|disable>**

Syntax **show port-security**

Syntax **action port=<num|list|range> <none|disable|drop>**

Syntax **signal port=<num|list|range> <none|log|trap|logandtrap>**

Syntax **ps <enable|disable>**

Syntax **remove mac=<all|address|list|range> port=<num|list|range>**

Syntax **signal port=<num|list|range> <none|log|trap|logandtrap>**

Where
allow mac – configures the switch to setup allowed MAC addresses on specific ports

learn port – configures the switch to learn the MAC addresses associated with specific port or a group of ports

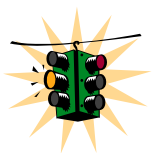
show port-security – shows the information on port security programmed or learnt

action port – specifies the designated action to take in case of a non authorized access

ps – port security – allows port security to be enable or disabled

remove mac – removes specific or all MAC addresses from port security lookup

signal port=<num|list|range> - observe list of specified ports and notify if there is a security breach on the list of port specified. The signal can be a log entry, a trap to the trap receiver specified as part of the SNMP commands (where is that specified) or both



Note 1: There is a limitation of 200 MAC addresses per port and 500 MAC addresses per Switch for Port Security.
Note 2: All the commands listed above have to be executed under the port-security configuration mode.

Syntax **clear <history|log [1..5 |informational |activity |critical |fatal |debug] |terminal |arp|portstats|addr]** – *clear command to clear various aspects of the MNS-6K information – most notably clear addr – clears the addresses learnt*

Let's look at a few examples.

```
Magnum6K25(port-security)## allow mac=00:c1:00:7f:ec:00,00:60:b0:88:9e:00
                                port=18
```

FIGURE 57 – *Port security – allowing specific MAC addresses on a specified port. (No spaces between specified MAC addresses)*

```
Magnum6K25(port-security)##  action port=9,10 none
Magnum6K25(port-security)##  learn port=9,10 enable
```

FIGURE 58 – *Port security - the port learns the MAC addresses. Note – a maximum of 200 MAC addresses can be learnt per port and a maximum of 500 per switch. Also, the 'action' on the port must be set to none before the port 'learns' the MAC address information.*

```
Magnum6K25(port-security)## ps enable
 Port Security is already enabled
Magnum6K25(port-security)## ps disable
 Port Security Disabled
Magnum6K25(port-security)## ps enable
 Port Security Enabled
```

FIGURE 59 – *Enabling and disabling port security*

```
Magnum6K25(port-security)## show port-security

PORT     STATE     SIGNAL      ACTION      LEARN      COUNT   MAC ADDRESS
--------  ----------  -----------  ----------  ----------  ----------  ----------------------
 9          ENABLE   LOG          NONE        ENABLE      6       00:e0:29:2a:f1:bd
                                                                   00:01:03:e2:27:89
                                                                   00:07:50:ef:31:40
                                                                   00:e0:29:22:15:85
                                                                   00:03:47:ca:ac:45
                                                                   00:30:48:70:71:23
 10         ENABLE   NONE         NONE        DISABLE     0       Not Configured
```

```
 11        ENABLE   NONE      NONE        DISABLE     0        Not Configured
 12        ENABLE   NONE      NONE        DISABLE     0        Not Configured
 13        ENABLE   NONE      NONE        DISABLE     0        Not Configured
 14        ENABLE   NONE      NONE        DISABLE     0        Not Configured
 15        ENABLE   NONE      NONE        DISABLE     0        Not Configured
 16        ENABLE   NONE      NONE        DISABLE     0        Not Configured

Magnum6K25(port-security)##
```

FIGURE 60 – *Viewing port security settings on a switch. On port 9, learning is enabled. This port has 6 stations connected to it with the MAC addresses as shown. Other ports have learning disabled and the MAC addresses are not configured on those ports*

```
Magnum6K25(port-security)## learn port=11 enable
  Port Learning Enabled on selected port(s)
Magnum6K25(port-security)## show port-security

PORT     STATE     SIGNAL      ACTION      LEARN     COUNT   MAC ADDRESS
-------- --------- ----------- ----------- --------- ------- ---------------------
 9         ENABLE   LOG         NONE        ENABLE    6       00:e0:29:2a:f1:bd
                                                              00:01:03:e2:27:89
                                                              00:07:50:ef:31:40
                                                              00:e0:29:22:15:85
                                                              00:03:47:ca:ac:45
                                                              00:30:48:70:71:23
 10        ENABLE   NONE        NONE        DISABLE   0       Not Configured
 11        ENABLE   NONE        NONE        ENABLE    0       Not Configured
 12        ENABLE   NONE        NONE        DISABLE   0       Not Configured
 13        ENABLE   NONE        NONE        DISABLE   0       Not Configured
 14        ENABLE   NONE        NONE        DISABLE   0       Not Configured
 15        ENABLE   NONE        NONE        DISABLE   0       Not Configured
 16        ENABLE   NONE        NONE        DISABLE   0       Not Configured

Magnum6K25(port-security)##
```

FIGURE 61 – *Enabling learning on a port. Note – after the learning is enabled, the port security can be queried to find the status of MAC addresses learnt. If there were machines connected to this port, the MAC address would be shown on port 11 as they are shown on port 9*

```
Magnum6K25(port-security)## allow mac=00:c1:00:7f:ec:00 port=9,11,13

  Specified MAC address(es) allowed on selected port(s)

Magnum6K25(port-security)## show port-security port=9,11,13

PORT     STATE     SIGNAL      ACTION      LEARN     COUNT   MAC ADDRESS
-------- --------- ----------- ----------- --------- ------- ---------------------
 9         ENABLE   LOG         NONE        ENABLE    6       00:e0:29:2a:f1:bd
                                                              00:01:03:e2:27:89
```

```
                                                                  00:07:50:ef:31:40
                                                                  00:e0:29:22:15:85
                                                                  00:03:47:ca:ac:45
                                                                  00:30:48:70:71:23
                                                                  00:c1:00:7f:ec:00
11          ENABLE   NONE       NONE        ENABLE       0       00:c1:00:7f:ec:00
13          ENABLE   NONE       NONE        DISABLE      0       00:c1:00:7f:ec:00
```

FIGURE 62 – *Allowing specific MAC address on specific ports. After the MAC address is specified, the port or specific ports or a range of ports can be queried as shown*

```
Magnum6K25(port-security)## remove mac=00:c1:00:7f:ec:00 port=13

 Specified MAC address(es) removed from selected port(s)

Magnum6K25(port-security)## show port-security port=13


PORT     STATE     SIGNAL      ACTION      LEARN     COUNT   MAC ADDRESS
--------  ----------  -----------  -----------  ----------  ----------  ----------------------
 13         ENABLE   LOG         NONE        ENABLE       0        Not Configured

Magnum6K25(port-security)##
```

FIGURE 63 – *Removing a MAC address from port security*

```
Magnum6K25(port-security)## signal port=11 logandtrap
 Port security Signal type set to Log and Trap on selected port(s)
```

FIGURE 64 – *Setting the logging on a port*

The figures listed above show the necessary commands to setup port security. The recommended steps to setup security are:

1) Set the MNS-6K software to allow port security commands (Use **'port-security'** command)
2) Enable port security (Use **'enable ps'** command)
3) Enable learning on the required ports (Use **'learn port=11 enable'** command for port 11)
4) Verify learning is enables and MAC addresses are being learnt on required ports (Use **'show port-security port=11'** command)
5) Save the port-security configuration (Use **'save'** command)
6) Disable learning on required ports (Use **'learn port=11,15 disable'** command)
7) (Optional step) Add any specific MAC addresses, if needed, to allow designated devices to access the network (Use **'add mac=00:c1:00:7f:ec:00 port=11,15'** command)
8) Disable access to the network for unauthorized devices (Use **'action port=11 <diable|drop>'** depending on whether the port should be disabled or the packed dropped. Follow that with a **'show port-security'** command to verify the setting)

9) (Optional step) Set the notification to notify the management station on security breach attempts (Use command **'signal port'** to make a log entry or send a trap)

```
Magnum6K25# port-security

Magnum6K25(port-security)## ps enable

Port Security is already enabled
Magnum6K25(port-security)## learn port=11 enable

 Port Learning Enabled on selected port(s)
Magnum6K25(port-security)## show port-security

PORT     STATE     SIGNAL      ACTION      LEARN      COUNT     MAC ADDRESS
--------  ----------  -----------  -----------  ----------  ----------  ----------------------
 9          ENABLE   LOG          NONE        ENABLE      6         00:e0:29:2a:f1:bd
                                                                    00:01:03:e2:27:89
                                                                    00:07:50:ef:31:40
                                                                    00:e0:29:22:15:85
                                                                    00:03:47:ca:ac:45
                                                                    00:30:48:70:71:23
 10         ENABLE   NONE         NONE        DISABLE     0         Not Configured
 11         ENABLE   NONE         NONE        ENABLE      0         00:c1:00:7f:ec:00
 12         ENABLE   NONE         NONE        DISABLE     0         Not Configured
 13         ENABLE   NONE         NONE        DISABLE     0         Not Configured
 14         ENABLE   NONE         NONE        DISABLE     0         Not Configured
 15         ENABLE   NONE         NONE        DISABLE     0         Not Configured
 16         ENABLE   NONE         NONE        DISABLE     0         Not Configured
Magnum6K25(port-security)## save

 Saving current configuration
 Configuration saved
Magnum6K25(port-security)## learn port=11 disable

 Port Learning Disabled on selected port(s)
Magnum6K25(port-security)##  action port=11 drop

 Port security Action type set to Drop on selected port(s)
Magnum6K25(port-security)## show port-security port=11

PORT     STATE     SIGNAL      ACTION      LEARN      COUNT     MAC ADDRESS
--------  ----------  -----------  -----------  ----------  ----------  ----------------------
 11         ENABLE   NONE         DROP        DISABLE     0         00:c1:00:7f:ec:00
Magnum6K25(port-security)## signal port=11 logandtrap

 Port security Signal type set to Log and Trap on selected port(s)
Magnum6K25(port-security)## exit

Magnum6K25#
```

FIGURE 65 – *Steps for setting up port security on a specific port*

Once port security is setup, it is important to manage the log and review the log often. If the signals are sent to the trap receiver, the traps should also be reviewed for intrusion and other infractions.

Syslog and Logs

Logs are available on MNS-6K as well as MNS-6K-SECURE. Syslog functionality is a feature of MNS-6K-SECURE.

All events occurring on the Magnum 6K family of switches are logged. These logs are in compliance with the definitions of RFC 3164, though not all the nuances of the syslog are implemented as specified by the RFC. As to what is done with each individual message, to quote the RFC, it will depend on individual companies policies.

"An administrator may want to have all messages stored locally as well as to have all messages of a high severity forwarded to another device. They may find it appropriate to also have messages from a particular facility sent to some or all of the users of the device and displayed on the system console.

However the administrator decides to configure the disposition of the event messages, the process of having them sent to a syslog collector generally consists of deciding which facility messages and which severity levels will be forwarded, and then defining the remote receiver. For example, an administrator may want all messages that are generated by the mail facility to be forwarded to one particular event message collector. Then the administrator may want to have all kernel generated messages sent to a different syslog receiver while, at the same time, having the critically severe messages from the kernel also sent to a third receiver. It may also be appropriate to have those messages displayed on the system console as well as being mailed to some appropriate people, while at the same time, being sent to a file on the local disk of the device. Conversely, it may be appropriate to have messages from a locally defined process only displayed on the console but not saved or forwarded from the device. In any event, the rules for this will have to be generated on the device. Since the administrators will then know which types of messages will be received on the collectors, they should then make appropriate rules on those syslog servers as well." – RFC 3164

The events can be as shown below

Code	Description
0	**Emergency** (or Fatal) system is unusable – called "fatal" in show log command
1	**Alert**: action must be taken immediately
2	**Critical**: critical conditions
3	**Error**: error conditions
4	**Warning**: warning conditions
5	**Notice**: normal but significant condition – called "note" in show log command
6	**Informational**: informational messages
7	**Debug**: debug-level messages

The above categories are defined for MNS as
fatal (or Emergency)
alert (same as Alert)
crit (or Critical)
error (same as Error)
warn (or Warning)
note (or Notice)
info (or Informational)
debug (same as Debug)

For example: **show log [fatal|alert|crit|error|warn|note|info|debug]**

A few point to note about logs

- By default, the logging is limited to the first six levels.
- The event log is now automatically saved to flash, so rebooting will not loose them. NOTE – since the event logs are written on the flash, once the flash memory is full, the logs stop writing. It is important to erase the log periodically or use syslog capability to download the logs to a syslog server (syslog is available on MNS-6K-SECURE only)
- The event log now includes more information, because of the additional flexibility built into the log engine. For example, it now logs the IP address and user name of a remote user login
- The log size parameter is now redefined as the max size of the log that is saved to flash. More events might appear in the log as they happen, but the whole list will be trimmed to the specified max size when a save command is issued, or the system rebooted.

These logs are in compliance with the definitions of RFC 3164, though not all the nuances of the syslog are implemented as specified by the RFC.

The **'show log'** command displays the log information and the **'clear log'** command clears the log entries.

Syntax **show log [fatal|alert|crit|error|warn|note|info|debug]** – *display the log*

Syntax **clear log [fatal|alert|crit|error|warn|note|info|debug]**– *clear the log*

Syntax **set logsize size=<1-1000>** - *set the number of line to be collected in the log before the oldest record is re-written*

Syntax **syslog** – *syslog context commands*

Syntax **server add host=<host|ip> [port=<port>] [event=<all|none|default|list>]** – *add a syslog server. Maximum of five servers can be defined*

Syntax **server edit id=<id> [host=<host|ip>] [port=<port>] [event=<all|none|default|list>]** - *edit the server setup as well as which syslog messages the server should receive*

Syntax **server del id=<id>** - *delete a Syslog server*

Syntax **server <enable|disable> id=<id>** - *enable or disable the log messages being sent to a syslog server*

Syntax **syslog <enable|enable>** - *enable (or disable) the syslog messages*

Syntax **show syslog** – *display the syslog settings*

```
Magnum6K25# show log
S     Date        Time          Log Description
--    -------     -------       ------------------------
Note  06-17-2007 09:57:27 P.M CLI:Session Timed Out for User manager on Telnet:
Note  06-17-2007 09:57:27 P.M CLI:Session Term. User manager on Telnet:
Note  06-17-2007 10:00:06 P.M CLI:Session Started from Telnet: 192.168.5.2
Note  06-17-2007 10:00:12 P.M CLI:User manager Login From Telnet: 192.168.5.2
Note  06-17-2007 10:08:58 P.M CLI:User manager Logout From Telnet: 192.168.5.2
Note  06-17-2007 10:08:58 P.M CLI:Session Term. User manager on Telnet:
Note  01-01-2001 12:00:00 A.M SYSMGR:System Was Rebooted By power cycle
Note  01-01-2001 12:00:00 A.M SNTP:System Clock Set to Default
Note  01-01-2001 12:01:32 A.M WEB:Session Started from SWM: 192.168.5.2
Note  01-01-2001 12:01:47 A.M WEB:User manager Login From SWM: 192.168.5.2
Note  01-01-2001 12:04:16 A.M SYSMGR:Loaded Application Ver 3.7
Note  01-01-2001 12:00:00 A.M SYSMGR:System Was Rebooted By HW Watchdog
Note  01-01-2001 12:00:00 A.M SNTP:System Clock Set to Default
Note  01-01-2001 12:01:13 A.M WEB:Session Started from SWM: 192.168.5.2
Note  01-01-2001 12:01:25 A.M WEB:User manager Login From SWM: 192.168.5.2
Note  06-23-2007 09:57:01 A.M SNTP:System Time Zone Set to -08:00
```

```
Note  06-23-2007 05:59:02 P.M SNTP:SNTP Client Started
Note  06-23-2007 05:59:09 P.M SNTP:SNTP Time Synchronized
Note  06-23-2007 05:59:10 P.M SNTP:SNTP Time Synchronized
Note  06-23-2007 05:59:36 P.M CLI:Session Started from Telnet: 192.168.5.2
Note  06-23-2007 05:59:39 P.M SNTP:SNTP Time Synchronized
Note  06-23-2007 05:59:40 P.M SNTP:SNTP Time Synchronized
Note  06-23-2007 05:59:49 P.M CLI:User manager Login From Telnet: 192.168.5.2
Note  06-23-2007 06:11:32 P.M CLI:Session Timed Out for User manager on Telnet:
Note  06-23-2007 06:11:32 P.M CLI:Session Term. User manager on Telnet:
Note  06-23-2007 06:18:05 P.M CLI:Session Started from Telnet: 192.168.5.2
Note  06-23-2007 06:18:16 P.M CLI:User manager Login From Telnet: 192.168.5.2

Magnum6K25# clear log

 Clear Logged Events? [ 'Y' or 'N']  Y

Magnum6K25# show log
```

Here we start setting up the syslog capabilities, a feature of MNS-6K-SECURE

```
Magnum6K25# show syslog

 SysLog Status: Disabled
 No Syslog Servers Configured.

 Local Log Events : Default

Magnum6K25# syslog

Magnum6K25 (syslog)## server ?

Usage
 server add host=<host|ip> [port=<port>] [event=<all|none|default|list>]
 server edit id=<id> [port=<port>] [event=<all|none|default|list>]
 server del id=<id>
 server <enable|disable> id=<id>

Magnum6K25 (syslog)## server add  host=192.168.5.2

 Server Added

Magnum6K25 (syslog)## show syslog

 SysLog Status: Disabled

 Server ID: 1
  SysLog Server Host : 192.168.5.2
  Server Logging   : Disabled
  Log Events       : Default

 Local Log Events : Default

Magnum6K25 (syslog)## server add host=192.168.5.98
```

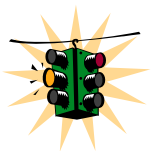
```
 Server Added
Magnum6K25 (syslog)## show syslog

 SysLog Status: Disabled

 Server ID: 1
  SysLog Server Host : 192.168.5.2
  Server Logging   : Disabled
  Log Events       : Default

 Server ID: 2
  SysLog Server Host : 192.168.5.98
  Server Logging   : Disabled
  Log Events       : Default

 Local Log Events : Default

Magnum6K25 (syslog)## server edit id=2 event=warn

 Server Modified
Magnum6K25 (syslog)## show syslog

 SysLog Status: Enabled

 Server ID: 1
  SysLog Server Host : 192.168.5.2
  Server Logging   : Disabled
  Log Events       : Default

 Server ID: 2
  SysLog Server Host : 192.168.5.98
  Server Logging    : Disabled
  Log Events       : warn

 Local Log Events : Default

Magnum6K25 (syslog)## server del id=1

 Server Deleted
Magnum6K25 (syslog)## show syslog

 SysLog Status: Disabled

 Server ID: 2
  SysLog Server Host : 192.168.5.98
  Server Logging    : Disabled
  Log Events       : warn

 Local Log Events : Default

Magnum6K25 (syslog)## server enable id=2
```

```
 Server Enabled
Magnum6K25 (syslog)## show syslog

 SysLog Status: Disabled

 Server ID: 2
   SysLog Server Host : 192.168.5.98
   Server Logging   : Enabled
   Log Events       : warn

 Local Log Events : Default

Magnum6K25 (syslog)## syslog enable

 SysLog Enabled

Magnum6K25 (syslog)## show syslog

 SysLog Status: Enabled

 Server ID: 2
   SysLog Server Host : 192.168.5.98
   Server Logging    : Enabled
   Log Events        : warn

 Local Log Events : Default

Magnum6K25 (syslog)## exit

Magnum6K25#
```

FIGURE 66 – *Show log and clear log command. Note the logs are in the syslog format. The syslog commands are also displayed*

The log shows the most recent event at the top of the listing. If the log is filled when the switch detects a new event, the oldest entry is dropped off the listing.

As discussed in the prior section, any port can be set to monitor security as well as make a log of the events that take place. The logs for the events are stored on the switch. When the switch detects an event on a port, it sets an "alert flag" for that port and makes the event information available.



The default log size is 50 rows. To change the log size, use the **"set logsize"** command.

When the switch detects an intrusion attempt on a port, it records the date and time stamp, the MAC address, the port on which the access was attempted and the action taken by MNS-6K software. The event log lists the most recently detected security violation

attempts. This provides a chronological entry of all intrusions attempted on a specific port.

The event log records events as single-line entries listed in chronological order, and serves as a tool for isolating problems. Each event log entry is composed of four fields
Severity – the level of severity (see below)
Date – date the event occurred on. See Chapter 3 on setting the date and time on the switch
Time – time the event occurred on. See Chapter 3 on setting the date and time on the switch
Log Description – description of event as detected by the switch

Severity is one of 8 severities described at the beginning of this section.

Authorized managers

This feature is available in MNS-6K-SECURE.

Just as port security allows and disallows specific MAC addresses from accessing a network, the MNS-6K software can allow or block specific IP addresses or a range of IP addresses to access the switch. The command used for that is

Syntax **access** – *access configuration mode*
Syntax **allow ip=<ipaddress> mask=<netmask> service=<name|list>** - *authorize managers*
Syntax **deny ip=<ipaddress> mask=<netmask> service=<name|list>** - *deny access to a specific IP address(s) or a subnet*
Syntax **remove ip=<ipaddress> mask=<netmask>** - *remove specific IP address(s) or subnet*
Syntax **removeall** - *remove all managers*

Syntax **show ip-access** – *display list of authorized managers*

access – context are the access commands

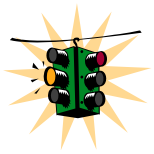
allow – allow specified services for specified IP addresses – IP addresses can be individual stations, a group of stations or subnets. The range is determined by the IP address and netmask settings

deny – deny specified services for specified IP addresses – IP addresses can be individual stations, a group of stations or subnets. The range is determined by the IP address and netmask settings

remove – eliminate specified entry from the authorized manager list

removeall – remove all authorized managers

service – the services allowed or denied are telnet, web and SNMP



It is assumed here that the user is familiar with IP addressing schemes (e.g. Class A, B, C etc.), subnet masking and masking issues such as how many stations are allowed for a given subnet mask.

In the examples – any computer on 192.168.5.0 network is allowed (note how the subnet mask is used to indicate that). Also a specific station with IP address 192.168.15.25 is allowed (again note how the subnet mask is used to allow only one specific station in the network.) Older station with IP address 192.168.15.15 is removed.

```
Magnum6K25# access

Magnum6K25(access)## allow ip=192.168.5.0 mask=255.255.255.0 service=telnet

 Service(s) allowed for specified address

Magnum6K25(access)## allow ip=192.168.15.25 mask=255.255.255.255 service=telnet

 Service(s) allowed for specified address

Magnum6K25(access)## remove ip=192.168.15.15 mask=255.255.255.255

 Access entry removed

Magnum6K25(access)## exit

Magnum6K25# show ip-access
=================================================================================
   IP Address    |     Mask          |  Telnet    |   Web      |    SNMP     |
=================================================================================
   192.168.5.0        255.255.255.0     ALLOWED    DENIED         DENIED
   192.168.15.25      255.255.255.255   ALLOWED    DENIED         DENIED
```

FIGURE 67 – *Steps to allow deny or remove specific services*

List of commands in this chapter

Syntax **set password** – *set or change password*

Syntax **configure port-security** – *sets the port authorization based on MAC addresses*

Syntax **port-security** – *configure port security settings*

Syntax **allow mac=<address|list|range> port=<num|list|range>** - *specify a specific MAC address or MAC address list*

Syntax **learn port=<number-list> <enable|disable>** - *learn MAC addresses connected to the Magnum 6K switch*

Syntax **show port-security** – *display port security settings*

Syntax **action port=<num|list|range> <none|disable|drop>** - *action to perform in case of breach of port security*

Syntax **signal port=<num|list|range> <none|log|trap|logandtrap>** - *port to monitor and signal to send in case of breach of port security*

Syntax **ps <enable|disable>** - *enable or disable port security*

Syntax **remove mac=<all|address|list|range> port=<num|list|range>** - *remove a MAC address entry*

Syntax **show log [fatal|alert|crit|error|warn|note|info|debug]** – *display the log*

Syntax **clear log [fatal|alert|crit|error|warn|note|info|debug]**– *clear the log*

Syntax **set logsize size=<1-1000>** - *set the number of line to be collected in the log before the oldest record is re-written*

Syntax **syslog** – *syslog context commands*

Syntax **server add host=<host|ip> [port=<port>] [event=<all|none|default|list>]** – *add a syslog server. Maximum of five servers can be defined*

Syntax **server edit id=<id> [host=<host|ip>] [port=<port>] [event=<all|none|default|list>]** - *edit the server setup as well as which syslog messages the server should receive*

Syntax **server del id=<id>** - *delete a Syslog server*

Syntax **server <enable|disable> id=<id>** - *enable or disable the log messages being sent to a syslog server*

Syntax **syslog <enable|enable>** - *enable (or disable) the syslog messages*

Syntax **show syslog** – *display the syslog settings*

Syntax **access** – *setup access configuration parameters*

Syntax **allow ip=<ipaddress> mask=<netmask> service=<name|list>** - *allow specific IP address or range of addresses as a trusted host(s)*

Syntax **deny ip=<ipaddress> mask=<netmask> service=<name|list>** *- deny specific IP address or range of IP addresses*

Syntax **remove ip=<ipaddress> mask=<netmask>** *- delete a specific IP address from the access or trusted host list*

Syntax **removeall** – *remove all IP addresses of trusted hosts*

Syntax **show ip-access** – *display all trusted hosts*

Syntax **clear <history|log [1..5 |informational |activity |critical |fatal |debug] |terminal |arp|portstats|addr]** – *clear command to clear various aspects of the MNS-6K information – most notably "clear addr" – clears the addresses learnt or "clear log" to clear the logs (and the type of logs)*

Chapter

8

8 – Access Using RADIUS

Using a RADIUS server to authenticate access….

This feature is available in MNS-6K-SECURE only. The IEEE 802.1x standard, *Port Based Network Access Control*, defines a mechanism for port-based network access control that makes use of the physical access characteristics of IEEE 802 LAN infrastructure. It provides a means of authenticating and authorizing devices attached to LAN ports that have point-to-point connection characteristics. It also prevents access to that port in cases where the authentication and authorization fails. Although 802.1x is mostly used in wireless networks, this protocol is also implemented in LANs. The Magnum 6K family of switches implements the authenticator, which is a major component of 802.1x.

RADIUS

Remote **A**uthentication **D**ial-**I**n **U**ser **S**ervice or RADIUS is a server that has been traditionally used by many Internet Service Providers (ISP) as well as Enterprises to authenticate dial in users. Today, many businesses use the RADIUS server for authenticating users connecting into a network. For example, if a user connects a PC into the network, whether the PC should be allowed access or not provides the same issues as to whether or not a dial in user should be allowed access into the network or not. A user has to provide a user name and password for authenticated access. A RADIUS server is well suited for controlling access into a network by managing the users who can access the network on a RADIUS server. Interacting with the server and taking corrective action(s) is not possible on all switches. This capability is provided on the Magnum 6K family of switches.

RADIUS servers and its uses are also described by one or more RFCs.

802.1x

There are three major components of 802.1x: - Supplicant, Authenticator and Authentication Server (RADIUS Server). In the figure below, the PC acts as the supplicant. The supplicant is an entity being authenticated and desiring access to the services. The switch is the authenticator. The authenticator enforces authentication before allowing access to services that are accessible via that port. The authenticator is responsible for communication with the supplicant and for submitting the information

received from the supplicant to a suitable authentication server. This allows the verification of user credentials to determine the consequent port authorization state. It is important to note that the authenticator's functionality is independent of the actual authentication method. It effectively acts as a pass-through for the authentication exchange.

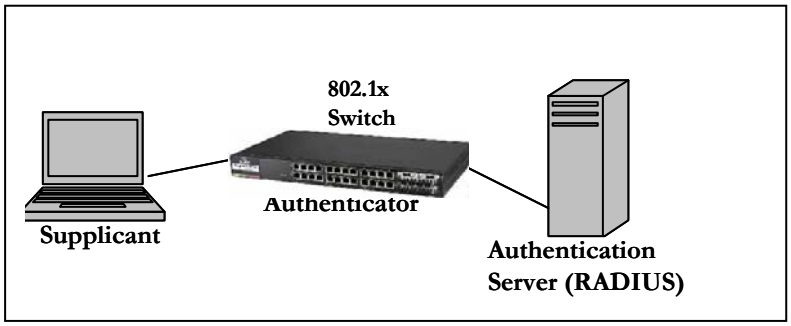


FIGURE 68 – *802.1x network components*

The RADIUS server is the authentication server. The authentication server provides a standard way of providing Authentication, Authorization, and Accounting services to a network. Extensible Authentication Protocol (EAP) is an authentication framework which supports multiple authentication methods. EAP typically runs directly over data link layers such as PPP or IEEE 802, without requiring IP. EAP over LAN (EAPOL) encapsulates EAP packets onto 802 frames with a few extensions to handle 802 characteristics. EAP over RADIUS encapsulates EAP packets onto RADIUS packets for relaying to RADIUS authentication servers.

The details of the 802.1x authentication are shown below

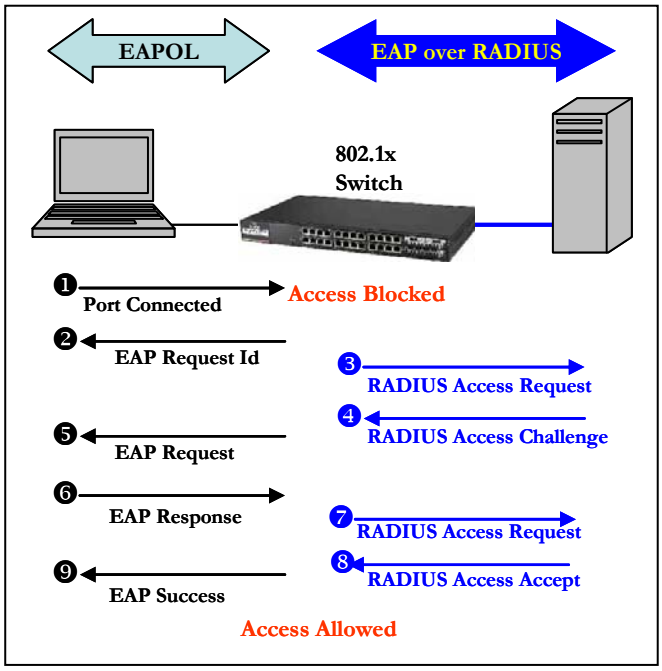


FIGURE 69 – *802.1x authentication details*

1. The supplicant (laptop/host) is initially blocked from accessing the network. The supplicant wanting to access these services starts with an EAPOL-Start frame
2. The authenticator (Magnum 6K switch), upon receiving an EAPOL-start frame, sends a response with an EAP-Request/Identity frame back to the supplicant. This will inform the supplicant to provide its identity
3. The supplicant then sends back its own identification using an EAP-Response/Identity frame to the authenticator (Magnum 6K switch.) The authenticator then relays this to the authentication server by encapsulating the EAP frame on a RADIUS-Access-Request packet
4. The RADIUS server will then send the authenticator a RADIUS-Access-Challenge packet
5. The authenticator (Magnum 6K switch) will relay this challenge to the supplicant using an EAP-Request frame. This will request the supplicant to pass its credentials for authentication
6. The supplicant will send its credentials using an EAP-Response packet
7. The authenticator will relay using a RADIUS-Access-Request packet
8. If the supplicant's credentials are valid, RADIUS-Access-Accept packet is sent to the authenticator
9. The authenticator will then relay this on as an EAP-Success and provides access to the network
10. If the supplicant does not have the necessary credentials, a RADIUS-Access-Deny packet is sent back and relayed to the supplicant as an EAP-Failure frame. The access to the network continues to be blocked

The Magnum MNS-6K software implements the 802.1x authenticator. It fully conforms to the standards as described in IEEE 802.1x, implementing all the state machines needed for port-based authentication. The Magnum MNS-6K Software authenticator supports both EAPOL and EAP over RADIUS to communicate to a standard 802.1x supplicant and RADIUS authentication server.

The Magnum MNS-6K software authenticator has the following characteristics:

- Allows control on ports using STP-based hardware functions. EAPOL frames are Spanning Tree Protocol (STP) link Bridge PDUs (BPDU) with its own bridge multicast address.
- Relays MD5 challenge (although not limited to) authentication protocol to RADIUS server
- Limits the authentication of a single host per port
- The Magnum 6K family of switches provides the IEEE 802.1x MIB for SNMP management

Configuring 802.1x

On enabling 802.1x ports, make sure the port which connects to the RADIUS servers needs to be manually authenticated. To authenticate the port, use the "**setport"** command. The CLI commands to configure and perform authentication with a RADIUS server are

Syntax **auth** - *configuration mode to configure the 802.1x parameters*

Syntax **show auth <config|ports> -** *show the 802.1x configuration or port status*

Syntax **authserver [ip=<ip-addr>] [udp=<num>] [secret=<string>] -** *define the RADIUS server – use UDP socket number if the RADIUS authentication is on port other than 1812*

Syntax **auth <enable|disable> -** *enables or disables the 802.1x authenticator function on MNS-6K switch*

Syntax **setport port=<num|list|range> [status=<enable|disable>] [control=<auto|forceauth|forceunauth>] [initialize=<assert|deassert>]** - *setting the port characteristic for an 802.1x network*

Syntax **backend port=<num|list|range> supptimeout=<1-240>] [servertimeout=<1-240>] [maxreq=<1-10>]** - *configure parameters for EAP over RADIUS*

port – [mandatory] – port(s) to be configured
supptimeout – [optional] This is the timeout in seconds the authenticator waits for the supplicant to respond back. Default value is 30 seconds. Values can range from 1 to 240 seconds.
servertimeout – [optional] This is the timeout in seconds the authenticator waits for the backend RADIUS server to respond back. The default value is 30 seconds. Values can range from 1 to 240 seconds.

maxreq – [optional] The maximum number of times the authenticator will retransmit an EAP Request packet to the Supplicant before it times out the authentication session. Its default value is 2. It can be set to any integer value from 1 to 10.

Syntax **portaccess port=<num|list|range> [quiet=<0-65535>] [maxreauth=<0-10>] [transmit=<1-65535>]** - *set port access parameters for authenticating PCs or supplicants*

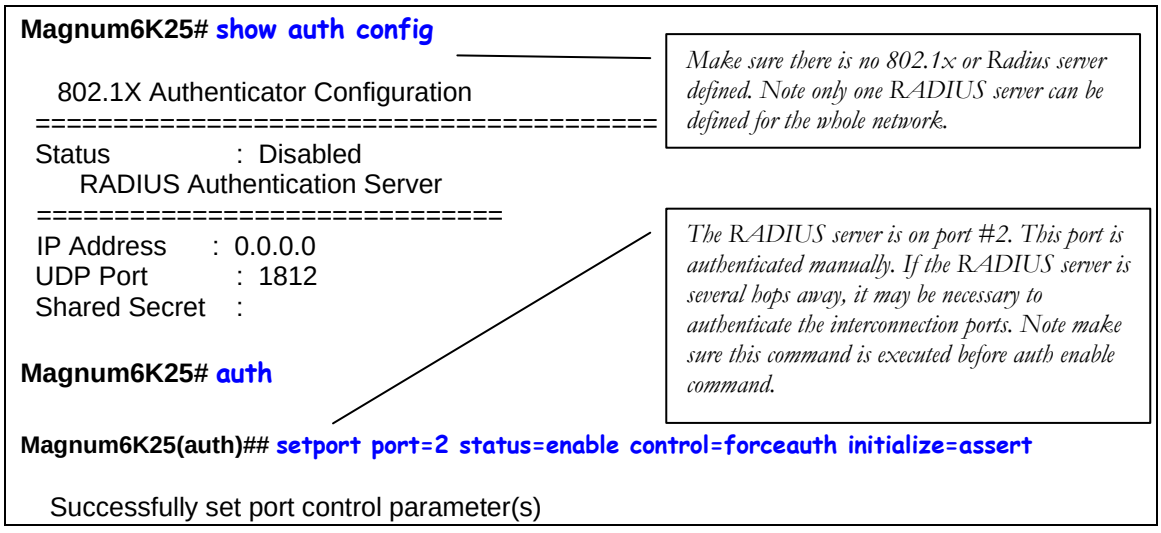
port – [mandatory] – ports to be configured
quiet – [optional] This is the quiet period, the amount of time, in seconds, the supplicant is held after an authentication failure before the authenticator retries the supplicant for connection. The default value is 60 seconds. Values can range from 0 to 65535 seconds.
maxreauth – [optional] The number of re-authentication attempts that are permitted before the port becomes unauthorized. Default value is 2. Values are integers and can range from 0 to 10.
transmit – [optional] This is the transmit period, this is the time in seconds the authenticator waits to transmit another request for identification from the supplicant. Default value is 30. Values can be from 1 to 65535 seconds

Syntax **reauth port=<num|list|range> [status=<enable|disable>] [period=<10-86400>]** - *set values on how the authenticator (Magnum 6K switch) does the re-authentication with the supplicant or PC*

port – [mandatory] – ports to be configured
status – [optional] This enables/disables re-authentication
period – [optional] this is the re-authentication period in seconds. This is the time the authenticator waits before a re-authentication process will be done again to the supplicant. Default value is 3600 seconds (1 hour). Values can range from 10 to 86400 seconds.

Syntax **show-stats port=<num> -** *displays 802.1x related statistics*

Syntax **trigger-reauth port=<num|list|range>** - *manually initiate a re-authentication of supplicant*



Magnum6K25(auth)## auth disable
802.1X Authenticator is disabled.

This command is not necessary, however is shown for completeness in case there was a RADIUS server defined and a previously set authentication scheme

Magnum6K25(auth)## authserver ip=192.168.1.239 secret=secret

Successfully set RADIUS Authentication Server parameter(s)

Magnum6K25(auth)##auth enable

Enable the authentication

802.1X Authenticator is enabled.

Magnum6K25(auth)## show auth ports

Port	Status	Control	Initialize	Current State
1	Enabled	Auto	Deasserted	Authorized
2	Enabled	ForcedAuth	Asserted	Unauthorized
3	Enabled	Auto	Deasserted	Authorized
4	Enabled	Auto	Deasserted	Unauthorized
5	Enabled	Auto	Deasserted	Unauthorized
6	Enabled	Auto	Deasserted	Unauthorized
7	Enabled	Auto	Deasserted	Unauthorized
8	Enabled	Auto	Deasserted	Unauthorized
9	Enabled	Auto	Deasserted	Unauthorized
10	Enabled	Auto	Deasserted	Unauthorized
11	Enabled	Auto	Deasserted	Unauthorized
12	Enabled	Auto	Deasserted	Unauthorized
13	Enabled	Auto	Deasserted	Unauthorized
14	Enabled	Auto	Deasserted	Unauthorized
15	Enabled	Auto	Deasserted	Unauthorized
16	Enabled	Auto	Deasserted	Unauthorized

-- Port not available

Port #2 is where RADIUS server is connected

Magnum6K25(auth)## show auth config

Command included for completeness – validate the RADIUS server settings

802.1x Authenticator Configuration
==========
Status : Enabled

RADIUS Authentication Server
==========
IP Address : 192.168.1.239
UDP Port : 1812
Shared Secret : secret

Magnum6K25(auth)## backend port=2 supptimeout=45 servertimeout=60 maxreq=5
Successfully set backend server authentication parameter(s)

Backend command is used for setting characteristics of the timeouts and number of requests before access is denied.

Magnum6K25(auth)## show-port backend

Port	Supp Timeout (sec)	Server Timeout (sec)	Max Request
1	30	30	2
2	45	60	5
3	30	30	2
4	30	30	2
5	30	30	2
6	30	30	2
7	30	30	2
8	30	30	2
9	30	30	2
10	30	30	2
11	30	30	2
12	30	30	2
13	30	30	2
14	30	30	2
15	30	30	2
16	30	30	2

The authenticator waits for the supplicant to respond back for 45 seconds; the authenticator waits for 60 seconds for the backend RADIUS server to respond back and the authenticator will retransmit an EAP request packet 5 times to the Supplicant before it times out the authentication session

Magnum6K25(auth)## portaccess port=2 quiet=120 maxreauth=7 transmit=120

Successfully set port access parameter(s)

Magnum6K25(auth)## show-port access

Port	Quiet Period (sec)	Max Reauth (sec)	Tx Period
1	60	2	30
2	120	7	120
3	60	2	30
4	60	2	30
5	60	2	30
6	60	2	30
7	60	2	30
8	60	2	30
9	60	2	30
10	60	2	30
11	60	2	30
12	60	2	30
13	60	2	30
14	60	2	30
15	60	2	30
16	60	2	30

The amount of time, in seconds, the supplicant is held after an authentication failure before the authenticator retries the supplicant for connection is changed to 120 seconds, the number of re-authentication attempts that are permitted before the Port becomes Unauthorized is set to 7 and the time in seconds the authenticator waits to transmit another request for identification from the supplicant is changed to 120 seconds. These values can be changed on all ports depending on devices being authenticated.

Magnum6K25(auth)## reauth port=1 status=enable period=300

Successfully set re-authentication parameter(s)

Force the authentication period on port #1 every 5 minutes – all other ports are force authenticated every hour as the show-port reauth command shows.

```
Magnum6K25(auth)## show-port reauth

Port        Reauth Status      Reauth Period (sec)
================================================
  1         Enabled            300
  2         Enabled            3600
  3         Enabled            3600
  4         Enabled            3600
  5         Enabled            3600
  6         Enabled            3600
  7         Enabled            3600
  8         Enabled            3600
  9         Enabled            3600
 10         Enabled            3600
 11         Enabled            3600
 12         Enabled            3600
 13         Enabled            3600
 14         Enabled            3600
 15         Enabled            3600
 16         Enabled            3600

Magnum6K25(auth)## show-stats port=3

Port 3 Authentication Counters
authEntersConnecting                          : 3
authEapLogoffsWhileConnecting                 : 0
authEntersAuthenticating                      : 3
authAuthSuccessesWhileAuthenticating          : 2
authAuthTimeoutsWhileAuthenticating           : 0
authAuthFailWhileAuthenticating               : 0
authAuthReauthsWhileAuthenticating            : 0
authAuthEapStartsWhileAuthenticating          : 1
authAuthEapLogoffWhileAuthenticating          : 0
authAuthReauthsWhileAuthenticated             : 0
authAuthEapStartsWhileAuthenticated           : 0
authAuthEapLogoffWhileAuthenticated           : 0
backendResponses                              : 5
backendAccessChallenges                       : 2
backendOtherRequestsToSupplicant              : 0
backendNonNakResponsesFromSupplicant          : 2
backendAuthSuccesses                          : 2
backendAuthFails                              : 0

Magnum6K25(auth)## trigger-reauth port=3

Successfully triggered re-authentication
```

See HFigure 47H for meaning of these statistics.

Force re-authentication on port #3.

FIGURE 70 – *securing the network using port access*

List of commands in this chapter

Syntax **auth** - *configuration mode to configure the 802.1x parameters*

Syntax **show auth <config|ports>** - *show the 802.1x configuration or port status*

Syntax **authserver [ip=<ip-addr>] [udp=<num>] [secret=<string>]** - *define the RADIUS server – use UDP socket number if the RADIUS authentication is on port other than 1812*

Syntax **auth <enable|disable>** - *enables or disables the 802.1x authenticator function on MNS-6K switch*

Syntax **setport port=<num|list|range> [status=<enable|disable>] [control=<auto|forceauth|forceunauth>] [initialize=<assert|deassert>]** - *setting the port characteristic for an 802.1x network*

Syntax **backend port=<num|list|range> supptimeout=<1-240>] [servertimeout=<1-240>] [maxreq=<1-10>]** - *configure parameters for EAP over RADIUS*

port – [mandatory] – port(s) to be configured
supptimeout – [optional] This is the timeout in seconds the authenticator waits for the supplicant to respond back. Default value is 30 seconds. Values can range from 1 to 240 seconds.
servertimeout – [optional] This is the timeout in seconds the authenticator waits for the backend RADIUS server to respond back. The default value is 30 seconds. Values can range from 1 to 240 seconds.
maxreq – [optional] The maximum number of times the authenticator will retransmit an EAP Request packet to the Supplicant before it times out the authentication session. Its default value is 2. It can be set to any integer value from 1 to 10.

Syntax **portaccess port=<num|list|range> [quiet=<0-65535>] [maxreauth=<0-10>] [transmit=<1-65535>]** - *set port access parameters for authenticating PCs or supplicants*

port – [mandatory] – ports to be configured
quiet – [optional] This is the quiet period, the amount of time, in seconds, the supplicant is held after an authentication failure before the authenticator retries the supplicant for connection. The default value is 60 seconds. Values can range from 0 to 65535 seconds.
maxreauth – [optional] The number of re-authentication attempts that are permitted before the port becomes unauthorized. Default value is 2. Values are integers and can range from 0 to 10.
transmit – [optional] This is the transmit period, this is the time in seconds the authenticator waits to transmit another request for identification from the supplicant. Default value is 30. Values can be from 1 to 65535 seconds

Syntax **reauth port=<num|list|range> [status=<enable|disable>] [period=<10-86400>]** - *set values on how the authenticator (Magnum 6K switch) does the re-authentication with the supplicant or PC*

port – [mandatory] – ports to be configured
status – [optional] This enables/disables re-authentication
period – [optional] this is the re-authentication period in seconds. This is the time the authenticator waits before a re-authentication process will be done again to the supplicant. Default value is 3600 seconds (1 hour). Values can range from 10 to 86400 seconds.

Syntax **show-stats port=<num>** - *displays 802.1x related statistics*

Syntax **trigger-reauth port=<num|list|range>** - *manually initiate a re-authentication of supplicant*

Chapter

9

9 – Access Using TACACS+

Using a TACACS+ server to authenticate access….

This feature is available in MNS-6K-SECURE. TACACS+, short for Terminal Access Controller Access Control System, protocol provides access control for routers, network access servers and other networked computing devices via one or more centralized servers. TACACS+ provides separate authentication, authorization and accounting services.

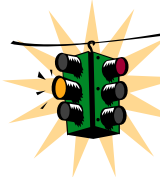
TACACS – flavors and history

TACACS allows a client to accept a username and password and send a query to a TACACS authentication server, sometimes called a TACACS daemon (server) or simply TACACSD. This server was normally a program running on a host. The host would determine whether to accept or deny the request and sent a response back.

The TACACS+ protocol is the latest generation of TACACS. TACACS is a simple UDP based access control protocol originally developed by BBN for the MILNET (Military Network). Cisco's enhancements to TACACS are called XTACACS. XTACACS is now replaced by TACACS+. TACACS+ is a TCP based access control protocol. TCP offers a reliable connection-oriented transport, while UDP offers best-effort delivery.

TACACS+ improves on TACACS and XTACACS by separating the functions of authentication, authorization and accounting and by encrypting all traffic between the Network Access Server (NAS) and the TACACS+ clients or services or daemon. It allows for arbitrary length and content authentication exchanges, which allows any authentication mechanism to be utilized with TACACS+ clients. The protocol allows the TACACS+ client to request very fine-grained access control by responding to each component of a request.

The Magnum 6K family of switches implements a TACACS+ client.



1. TACACS+ servers and daemons use TCP Port 49 for listening to client requests. Clients connect to this port number to send authentication and authorization packets.
2. There can be more than one TACACS+ server on the network. MNS-6K supports a maximum of five TACACS+ servers

TACACS+ Flow

TACACS works in conjunction with the local user list on the MNS-6K software (operating system.) Please refer to User Management for adding users on the MNS-6K software. The process of authentication as well as authorization is shown in the flow chart below.

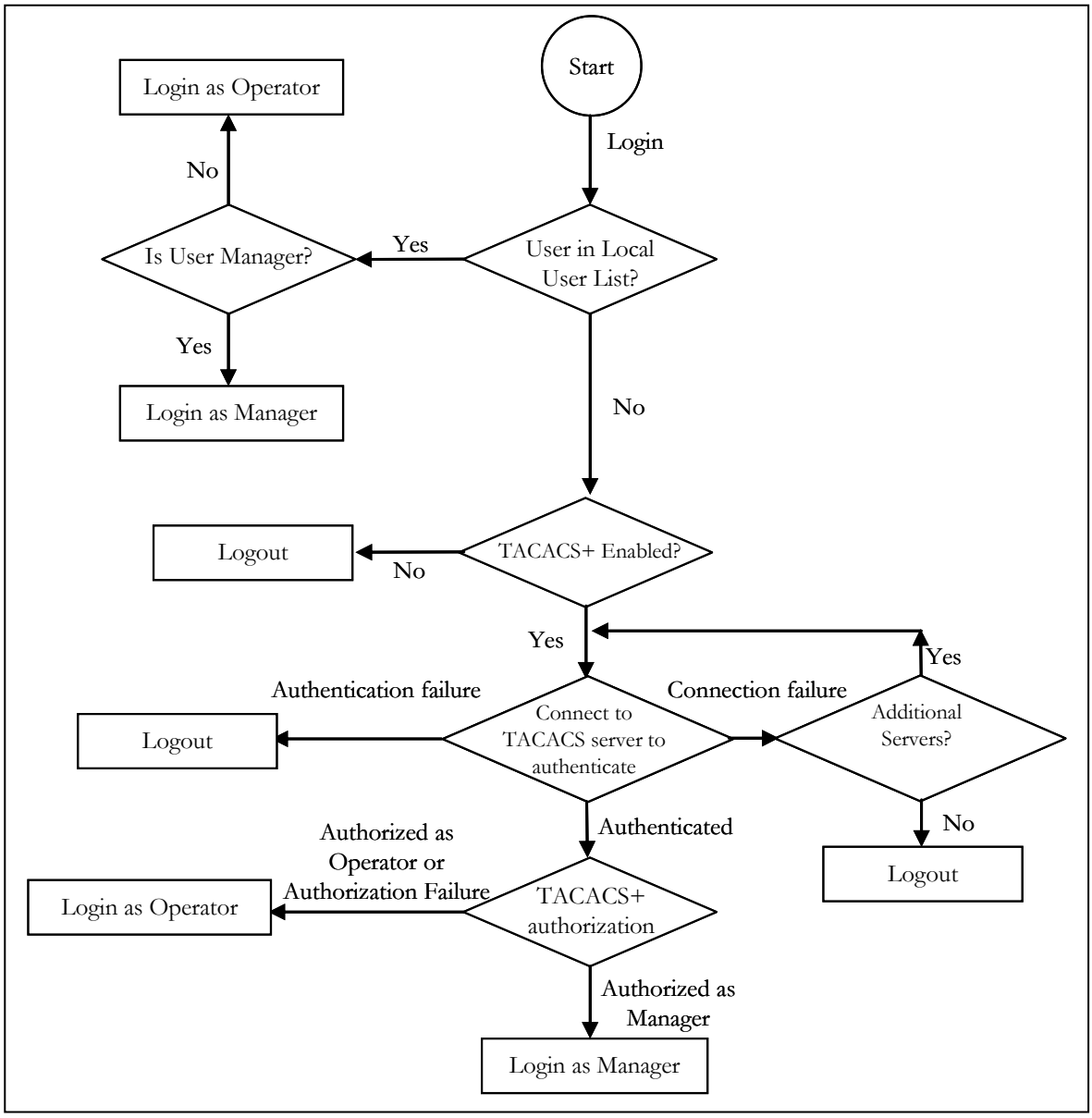


FIGURE 71 – *Flow chart describing the interaction between local users and TACACS authorization*

The above flow diagram shows the tight integration of TACACS+ authentication with the local user-based authentication. There are two stages a user goes through in TACACS+. The first stage

is authentication where the user is verified against the network user database. The second stage is authorization, where it is determined whether the user has operator access or manager privileges.

TACACS+ Packet

Packet encryption is a supported and is a configurable option for the Magnum MNS-6K software. When encrypted, all authentication and authorization TACACS+ packets are encrypted and are not readable by protocol capture and sniffing devices such as EtherReal or others. Packet data is hashed and shared using MD5 and secret string defined between the Magnum 6K family of switches and the TACACS+ server.

32 bits wide				
4	4	8	8	8 bits
Major Version	Minor Version	Packet type	Sequence no.	Flags
Session ID				
Length				

FIGURE 72 – *TACACS packet format*

- Major Version – The major TACACS+ version number.
- Minor version – The minor TACACS+ version number. This is intended to allow revisions to the TACACS+ protocol while maintaining backwards compatibility
- Packet type – Possible values are
  TAC_PLUS_AUTHEN:= 0x01 (Authentication)
  TAC_PLUS_AUTHOR:= 0x02 (Authorization)
  TAC_PLUS_ACCT:= 0x03 (Accounting)
- Sequence number – The sequence number of the current packet for the current session
- Flags – This field contains various flags in the form of bitmaps. The flag values signify whether the packet is encrypted
- Session ID – The ID for this TACACS+ session
- Length - The total length of the TACACS+ packet body (not including the header)

Configuring TACACS+

CLI commands to configure TACACS+ are

Syntax **show tacplus <status|servers>** - *show status of TACACS or servers configured as TACACS+ servers*

Syntax **tacplus <enable|disable> [order=<tac,local | local,tac>]** - *enable or disable TACACS authentication, specifying the order in which the server or local database is looked up where "tac,local" implies, first the TACAS+ server, then local logins on the device. Default order is Local then TACACS+ server.*

Syntax **tacserver <add|delete> id=<num> [ip=<ip-addr>] [port=<tcp-port>] [encrypt=<enable|disable>] [key=<string>] [mgrlevel=<level>] [oprlevel=<level>]** – *adds a list of up to five TACACS+ servers where*

<add|delete> – [mandatory] adds or delete a TACACS+ server.

id=<num> – [mandatory] the order in which the TACACS+ servers should be polled for authenticaton

[ip=<ip-addr>] – [mandatory for add] the IP address of the TACACS+ server

[port=<tcp-port>] – [optional for add] TCP port number on which the server is listening

[encrypt=<enable|disable>] – [optional for add] enable or disable packet encryption

[key=<string>] – [optional for add, mandatory with encrypt] when encryption is enabled, the secret shared key string must be supplied

[mgrlevel=<level>] and **[oprlevel=<level>]** – [optional] specifies the manager and operator level as defined on the TACACS+ server for the respective level of login

This command works in the user configuration mode as well. Note – maximum of five TACACS+ servers.

```
Magnum6K25# show tacplus servers

 ID      TACACS+ Server          Port        Encrypt     Key
 ================================================
 1       10.21.1.170             49          Enabled     secret
 2        --                      --          --          --
 3       --                      --          --          --
 4       --                      --          --          --
 5       --                      --          --          --
```

To configure TACACS+ enter the user configuration mode

```
Magnum6K25# user

Magnum6K25(user)##
```

Check the status of TACACS+ authentication. Note – this command was run in the user configuration mode.

```
Magnum6K25(user)## show tacplus status

 TACACS+ Status          : Disabled

Magnum6K25(user)## tacplus disable

 TACACS+ Tunneling is disabled.

Magnum6K25(user)## tacserver add id=2 ip=10.21.1.123 encrypt=enable key=some

 TACACS+ server is added.

Magnum6K25(user)## show tacplus servers

 ID      TACACS+ Server          Port        Encrypt     Key
```

```
================================================
1       10.21.1.170              49        Enabled   secret
2       10.21.1.123              49        Enabled   some
3       --                       --        --        --
4       --                       --        --        --
5       --                       --        --        --

Magnum6K25(user)## tacserver delete id=2

 TACACS+ server is deleted.

Magnum6K25(user)## show tacplus servers

 ID     TACACS+ Server           Port      Encrypt   Key
================================================
1       10.21.1.170              49        Enabled   secret
2       --                       --        --        --
3       --                       --        --        --
4       --                       --        --        --
5       --                       --        --        --

Magnum6K25(user)## tacplus enable

 TACACS+ is enabled.

 Magnum6K25(user)##
```

FIGURE 73 – *Configuring TACACS+*

List of commands in this chapter

Syntax **show tacplus <status|servers>** - *show status of TACACS or servers configured as TACACS+ servers*

Syntax **tacplus <enable|disable> [order=<tac,local | local,tac>]** - *enable or disable TACACS authentication, specifying the order in which the server or local database is looked up where "tac,local" implies, first the TACAS+ server, then local logins on the device*

Syntax **tacserver <add|delete> id=<num> [ip=<ip-addr>] [port=<tcp-port>] [encrypt=<enable|disable>] [key=<string>] [mgrlevel=<level>] [oprlevel=<level>]** – *adds a list of up to five TACACS+ servers where*

<add|delete> – [mandatory] adds or delete a TACACS+ server.
id=<num> – [mandatory] the order in which the TACACS+ servers should be polled for authenticaton
[ip=<ip-addr>] – [mandatory for add] the IP address of the TACACS+ server
[port=<tcp-port>] – [optional for add] TCP port number on which the server is listening
[encrypt=<enable|disable>] – [optional for add] enable or disable packet encryption

[key=<string>] – [optional for add, mandatory with encrypt] when encryption is enabled, the secret shared key string must be supplied
[mgrlevel=<level>] and **[oprlevel=<level>]** – [optional] specifies the manager and operator level as defined on the TACACS+ server for the respective level of login

Chapter

10

10 – Port Mirroring and Setup

Setup the ports for network speeds, performance as well as for monitoring….

This section explains how individual characteristics of a port on the GarrettCom Magnum 6K family of switches are setup. For monitoring a specific port, the traffic on a port can be mirrored on another port and viewed by protocol analyzers. Other setup includes automatically setting up broadcast storm prevention thresholds.

Port monitoring and mirroring

An Ethernet switch sends traffic from one port to another port, unlike a hub or a shared network device, where the traffic is "broadcast" on each and every port. Capturing traffic for protocol analysis or intrusion analysis can be impossible on a switch unless all the traffic for a specific port is "reflected" on another port, typically a monitoring port. The Magnum 6K family of switches can be instructed to repeat the traffic from one port onto another port. This process - when traffic from one port is reflecting to another port - is called port mirroring. The monitoring port is also called a "sniffing" port. Port monitoring becomes critical for trouble shooting as well as for intrusion detection.

Port mirroring

Monitoring a specific port can be done by port mirroring. Mirroring traffic from one port to another port allows analysis of the traffic on that port. The set of commands for port mirroring are

Syntax **show port-mirror** – *displays the status of port mirroring*

Syntax **port-mirror** - *enter the port mirror configuration mode*

Syntax **setport monitor=<monitor port number> sniffer=<sniffer port number>** - *setup a prot mirrior port*

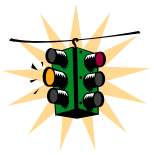
Syntax **prtmr <enable|disable>** - *enable and disable port mirroring*

The set of commands show how port 11 is mirrored on port 13. Any traffic on port 11 is also sent on port 13.

```
Magnum6K25# show port-mirror
  Sniffer Port      : 0
  Monitor Port      : 0
  Mirroring State   : disabled
Magnum6K25# port-mirror
Magnum6K25(port-mirror)## setport monitor=11 sniffer=13
Port 11 set as Monitor Port
Port 13 set as Sniffer Port
Magnum6K25(port-mirror)## prtmr enable
Port Mirroring Enabled
Magnum6K25(port-mirror)## exit
Magnum6K25# show port-mirror
  Sniffer Port      : 13
  Monitor Port      : 11
  Mirroring State   : enabled
Magnum6K25#
```

FIGURE 74 – *Enabling port mirroring*

Once port monitoring is completed, for security reasons, GarrettCom strongly recommends that the port mirroring be disabled using the **"prtmr diable"** command.



1) Only one port can be set to port mirror at a time
2) Both the ports (monitored port and sniffer port) have to belong to the same VLAN
3) The mirrored port shows both incoming as well as outgoing traffic
4) When port mirror is active, to change mirrored port, first disable port mirror and then assign the new port as described above

Port setup

Each port on the GarrettCom Magnum 6K family of switches can be setup specific port characteristics. The command for setting the port characteristics are:

Syntax **device** – *enter the device configuration mode*

Syntax **setport port=<port#|list|range> [name=<name>] [speed=<10|100>] [duplex=<half|full>] [auto=<enable|disable>] [flow=<enable|disable>] [bp=<enable|disable>] [status=<enable|disable>]**

where
device – sets up the Magnum 6K switch in the device configuration mode
name – assigns a specific name to the port. This name is a designated name for the port and can be a server name, user name or any other name

speed – specifically sets the speed to be 10 or 100Mbps. Note – this works only with 10/100 ports – with 10Mbps ports, the option is ignored. No error is shown. See speed settings section below.
flow – sets up flow control on the port. See Flow Control section below
bp – back pressure – enables back pressure signaling for traffic congestion management
status – disable – disables the port from operation

Syntax **show port[=<port number>]**

In the example listed below, the ports 11 and 12 are given specific names. Ports 9 and 13 are active, as shown by the link status. Port 13 is set to 100 Mbps – all other ports are set to 10Mbps. All ports are set with auto sensing (speed)

```
Magnum6K25# device

Magnum6K25(device)## setport port=11 name=JohnDoe

Magnum6K25(device)## setport port=12 name=JaneDoe

Magnum6K25(device)##  show port

Keys:     E  = Enable                D  = Disable
          H  = Half Duplex           F  = Full Duplex
          M  = Multiple VLANs        NA = Not Applicable
          LI = Listening             LE = Learning
          F  = Forwarding            B  = Blocking
Port Name   Status   Dplx  Media Link   Speed  Part   Auto Vlan  GVRP STP
-------------------------------------------------------------------------------------------------
 9   B1       E       H     10Tx  UP      10    No      E    1      -    -
10   B2       E       H     10Tx  DOWN    10    No      E    1      -    -
11   JohnDoe  E       H     10Tx  DOWN    10    No      E    1      -    -
12   JaneDoe  E       H     10Tx  DOWN    10    No      E    1      -    -
13   B5       E       F     100Tx UP      100   No      E    1      -    -
14   B6       E       H     10Tx  DOWN    10    No      E    1      -    -
15   B7       E       H     10Tx  DOWN    10    No      E    1      -    -
16   B8       E       H     10Tx  DOWN    10    No      E    1      -    -

Magnum6K25(device)## exit
Magnum6K25#
```

FIGURE 75 – *Port setup*

The port's speed and duplex (data transfer operation) setting are summarized below.

Speed settings

Auto (default) – Senses speed and negotiates with the port at the other end of the link for data transfer operation (half-duplex or full-duplex). "Auto" uses the IEEE 802.3u auto negotiation standard for 100Base-T networks. If the other device does not comply

with the 802.3u standard, then the port configuration on the switch must be manually set to match the port configuration on the other device.

Possible port setting combinations for copper ports are:

- 10HDx: 10 Mbps, Half-Duplex
- 10FDx: 10 Mbps, Full-Duplex
- 100HDx: 100 Mbps, Half-Duplex
- 100FDx: 100 Mbps, Full-Duplex

Possible port settings for 100FX (fiber) ports are:

- 100FDx (default): 100 Mbps, Full-Duplex
- 100HDx: 100 Mbps, Half-Duplex

Possible port settings for 10FL (fiber) ports are:

- 10HDx (default): 10 Mbps, Half-Duplex
- 10FDx: 10 Mbps, Full-Duplex

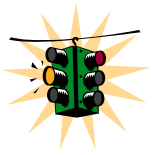
Gigabit fiber-optic ports (Gigabit-SX and Gigabit-LX):

- 1000FDx (default): 1000 Mbps (1 GBPS), Full Duplex only
- **Auto**: The port operates at 1000FDx and auto-negotiates flow control with the device connected to the port

Flow Control

Flow control is for full duplex operation and the controls provided indicates the number of buffers allowed for incoming traffic before a Rxon or Rxoff information is sent. RXon is sent when the number of buffers used by the traffic falls below the specified level (default is 4). Rxoff is sent when the number of buffers used goes above the specified value (default is 6). The "flowcontrol" command is used to set the above thresholds. It DOES NOT enable or DISABLE flow control

Disabled (default) – The port will not generate flow control packets and drops received flow control packets
Enabled: The port uses 802.3x Link Layer Flow Control, generates flow control packets, and processes received flow control packets.



With the port speed set to auto (the default) and flow control set to enabled; the switch negotiates flow control on the indicated port. If the port speed is not set to auto, or if flow control is disabled on the port, then flow control is not used.

To set flow control

Syntax **flowcontrol xonlimit=<value> xofflimit=<value>**

where
xonlimit can be from 3 to 30, default value is 4
xofflimit from 3 to 127, default value is 6

Syntax **show flowcontrol**

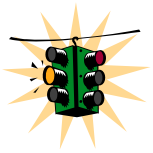
Back Pressure

Back Pressure is for half duplex operations and the controls provided indicates the number of buffers allowed for incoming traffic before a xon/xoff message is sent.

Disabled (default) – The port will not use back pressure based flow control mechanisms. **Enabled** – The port uses 802.3 Layer 2 back off algorithms. Back pressure based congestion control is possible only on half-duplex, 10-Mbps Ethernet ports. Other technologies are not supported on Magnum 6K family of switches.

Syntax **backpressure rxthreshold=<value>**
where
rxthreshold value can be from 3 to 127, default is 28

Syntax **show backpressure**



Backpressure and Flow control are to be used in networks in which all devices and switches can participate in the flow control and back pressure recognition. In most networks, these techniques are not used as not all devices can participate in the flow control methods and notifications. Alternately, QoS and other techniques are widely used today.

In the example below, the Magnum 6K family of switches are setup with flow control and back pressure.

```
Magnum6K25# device
Magnum6K25(device)## show flowcontrol
  XOnLimit  : 4
  XOffLimit : 6
Magnum6K25(device)## flowcontrol xonlimit=10 xofflimit=15
 XOn Limit set successfully
 XOff Limit set successfully
Magnum6K25(device)## show flowcontrol
  XOnLimit  : 10
  XOffLimit : 15
Magnum6K25(device)## show backpressure
  Rx Buffer Threshold : 28
Magnum6K25(device)## backpressure rxthreshold=45
 Rx Buffer Threshold set successfully
Magnum6K25(device)## show backpressure
  Rx Buffer Threshold : 45
Magnum6K25(device)## show port

Keys:     E  = Enable                D  = Disable
          H  = Half Duplex           F  = Full Duplex
          M  = Multiple VLAN's       NA = Not Applicable
          LI = Listening             LE = Learning
          F  = Forwarding            B  = Blocking
Port  Name    Status    Dplx  Media  Link   Speed  Part   Auto  Vlan   GVRP  STP
-------------------------------------------------------------------------------------------------------
 9    B1        E        H     10Tx   UP      10    No      E     1      -     -
10    B2        E        H     10Tx   DOWN    10    No      E     1      -     -
11    JohnDoe   E        H     10Tx   DOWN    10    No      E     1      -     -
12    JaneDoe   E        H     10Tx   DOWN    10    No      E     1      -     -
13    B5        E        F     100Tx  UP      100   No      E     1      -     -
14    B6        E        H     10Tx   DOWN    10    No      E     1      -     -
15    B7        E        H     10Tx   DOWN    10    No      E     1      -     -
16    B8        E        H     10Tx   DOWN    10    No      E     1      -     -

Magnum6K25(device)## show port=11
Configuration details of port 11
-------------------------------------------------
Port Name                       : JohnDoe
Port Link State                 : DOWN
Port Type                       : TP Port
Port Admin State                : Enable
Port VLAN Memberships           : 1
Port Speed                      : 10Mbps
Port Duplex Mode                : half-duplex
Port Auto-negotiation State     : Enable
Port STP State                  : NO STP
Port GVRP State                 : No GVRP
Port Priority Type              : None
Port Security                   : Enable
Port Flow Control               : Disable (Admin Status : Disable)
```

```
Port Back Pressure              : Disable
Port Events Notify              : log,trap,alarm

Magnum6K25(device)## setport port=11 flow=enable bp=enable
Magnum6K25(device)## show port
Keys:     E  = Enable                D  = Disable
           H  = Half Duplex          F  = Full Duplex
          M  = Multiple VLAN's       NA = Not Applicable
          LI = Listening             LE = Learning
          F  = Forwarding            B  = Blocking
Port  Name    Status    Dplx  Media  Link   Speed  Part   Auto  Vlan   GVRP  STP
-------------------------------------------------------------------------------------------------------
 9    B1        E        H     10Tx   UP      10    No      E     1      -     -
10    B2        E        H     10Tx   DOWN    10    No      E     1      -     -
11    JohnDoe   E        H     10Tx   DOWN    10    No      E     1      -     -
12    JaneDoe   E        H     10Tx   DOWN    10    No      E     1      -     -
13    B5        E        F     100Tx  UP      100   No      E     1      -     -
14    B6        E        H     10Tx   DOWN    10    No      E     1      -     -
15    B7        E        H     10Tx   DOWN    10    No      E     1      -     -
16    B8        E        H     10Tx   DOWN    10    No      E     1      -     -
Magnum6K25(device)## show port=11
Configuration details of port 11
-------------------------------------------------
Port Name                       : JohnDoe
Port Link State                 : DOWN
Port Type                       : TP Port
Port Admin State                : Enable
Port VLAN ID                    : 1
Port Speed                      : 10Mbps
Port Duplex Mode                : half-duplex
Port Auto-negotiation State     : Enable
Port STP State                  : NO STP
Port GVRP State                 : No GVRP
Port Priority Type              : None
Port Security                   : Enable
Port Flow Control               : Enable (Admin Status : Enable)
Port Back Pressure              : Enable
Port Events Notify              : log,trap,alarm

Magnum6K25(device)## exit
Magnum6K25#
```

Note – the flow control and back pressure is shown as enabled for the specific port. The global "show port" command does not show this detail. The back pressure and flow control parameters are global – i.e. the same for all the ports.

FIGURE 76 – *Setting up back pressure and flow control on ports*

Broadcast Storms

One of the best features of the Magnum 6K family of switches is its ability to keep broadcast storms from spreading throughout a network. Network storms (or broadcast storms) are characterized by an excessive number of broadcast packets being sent over the network. These storms can occur if network equipment is configured incorrectly or the network software is not properly functioning or badly designed

programs (including some network games) are used. Storms can reduce network performance and cause bridges, routers, workstations, servers and PC's to slow down or even crash.

Preventing broadcast storms

The Magnum 6K family of switches is capable of detecting and limiting storms on each port. A network administrator can also set the maximum rate of broadcast packets (frames) that are permitted from a particular interface. If the maximum number is exceeded, a storm condition is declared. Once it is determined that a storm is occurring on an interface, any additional broadcast packets received on that interface will be dropped until the storm is determined to be over. The storm is determined to be over when a one-second period elapses with no broadcast packets received.

Syntax **broadcast-protect <enable|disable>** *- enable or disable the broadcast storm protection capabilities*

Syntax **rate-threshold port=<port|list|range> rate=<frames/sec>** *- set the rate limit in frames per second*

Syntax **show broadcast-protect** – *display the broadcast storm protection settings*

In the example below, the broadcast protection is turned on. The threshold for port 11 is then set to a lower value of 3500 broadcast frames/second.

```
Magnum6K25# device
Magnum6K25(device)## show broadcast-protect
 ================================================================
 PORT |  STATUS  | THRESHOLD (frms/sec) | CURR RATE (frms/sec) | ACTIVE
 ================================================================
   9        Disabled     19531                  0                NO
  10        Disabled     19531                  0                NO
  11        Disabled     19531                  0                NO
  12        Disabled     19531                  0                NO
  13        Disabled     19531                  0                NO
  14        Disabled     19531                  0                NO
  15        Disabled     19531                  0                NO
  16        Disabled     19531                  0                NO
Magnum6K25(device)## broadcast-protect enable
 Broadcast Storm Protection enabled

Magnum6K25(device)## show broadcast-protect
 ================================================================
 PORT |  STATUS  | THRESHOLD (frms/sec) | CURR RATE (frms/sec) | ACTIVE
 ================================================================
   9        Enabled      19531                  0                NO
  10        Enabled      19531                  0                NO
  11        Enabled      19531                  0                NO
  12        Enabled      19531                  0                NO
```

```
   13      Enabled     19531              0              NO
   14      Enabled     19531              0              NO
   15      Enabled     19531              0              NO
   16      Enabled     19531              0              NO
Magnum6K25(device)## rate-threshold port=11 rate=3500
Broadcast Rate Threshold set
Magnum6K25(device)## show broadcast-protect
 ================================================================
 PORT |  STATUS  | THRESHOLD (frms/sec) | CURR RATE (frms/sec) | ACTIVE
 ================================================================
   9      Enabled     19531              0              NO
   10     Enabled     19531              0              NO
   11     Enabled     3500               0              NO
   12     Enabled     19531              0              NO
   13     Enabled     19531              0              NO
   14     Enabled     19531              0              NO
   15     Enabled     19531              0              NO
   16     Enabled     19531              0              NO
```

FIGURE 77 – *Setting up broadcast storm protection. Also shows how the threshold can be lowered for a specific port*

Port Rate limiting for broadcast traffic

Please refer to the above section on broadcast storms.

List of commands in this chapter

Syntax **show port-mirror** – *display port mirror settings*

Syntax **port-mirror <enter>** - *configure port mirror settings*

Syntax **setport monitor=<monitor port number> sniffer=<sniffer port number>** - *set port mirror settings*

Syntax **prtmr <enable|disable>** - *enable or disable port mirror settings*

Syntax **device** – *configure device and port specific settings*

Syntax **setport port=<port#|list|range> [name=<name>] [speed=<10|100>] [duplex=<half|full>] [auto=<enable|disable>] [flow=<enable|disable>] [bp=<enable|disable>] [status=<enable|disable>]** – *configure port settings*

Syntax **show port[=<Port number>]** – *display port settings*

Syntax **flowcontrol xonlimit=<value> xofflimit=<value>** *- configure flow control buffers*

Syntax **show flowcontrol** – *display flow control buffers*

Syntax **backpressure rxthreshold=<value>** *- configure backpressure buffers*

Syntax **show backpressure** – *display backpressure buffers*

Syntax **broadcast-protect <enable|disable>** *- protect switch from broadcast storms*

Syntax **rate-threshold port=<port|list|range> rate=<frames/sec>** *- change the allowed broadcast rate threshold*

Chapter

11

11 – VLAN

Create separate network segments (collision domains) across Magnum 6K family of switches…..

Short for **virtual LAN (VLAN)**, a VLAN creates separate collision domains or network segments that can span multiple Magnum 6K family of switches. A VLAN is a group of ports designated by the switch as belonging to the same broadcast domain. The IEEE 802.1Q specification establishes a standard method for inserting VLAN membership information into Ethernet frames.

Why VLANs?

VLAN's provide the capability of having two (or more) Ethernet segments co-exist on common hardware. The reason for creating multiple segments in Ethernet is to isolate collision domains. VLANs can isolate groups of users, or divide up traffic for security, bandwidth management, etc. VLANs are widely used today and are here to stay. VLANs need not be in one physical location. They can be spread across geography or topology. VLAN membership information can be propagated across multiple Magnum6K switches.

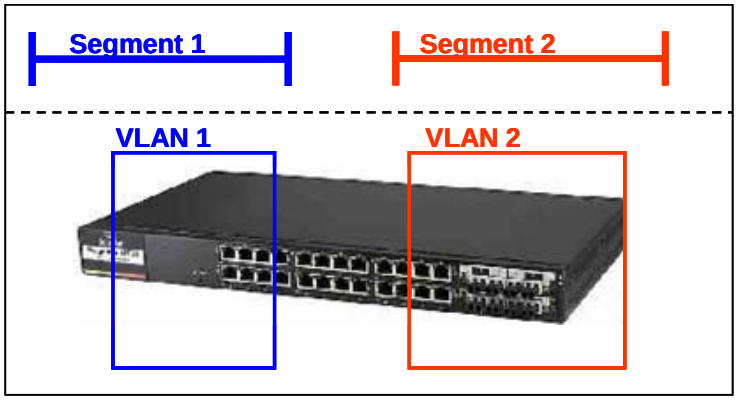


FIGURE 78 – *VLAN as two separate collision domains. The top part of the figure shows two "traditional" Ethernet segments.*

A group of network users (ports) assigned to a VLAN form a broadcast domain. Packets are forwarded only between ports that are designated for the same VLAN. Cross-domain broadcast traffic in the switch is eliminated and bandwidth is saved by not allowing packets to flood out on all ports. For many reasons a port may be configured to belong to multiple VLANs.

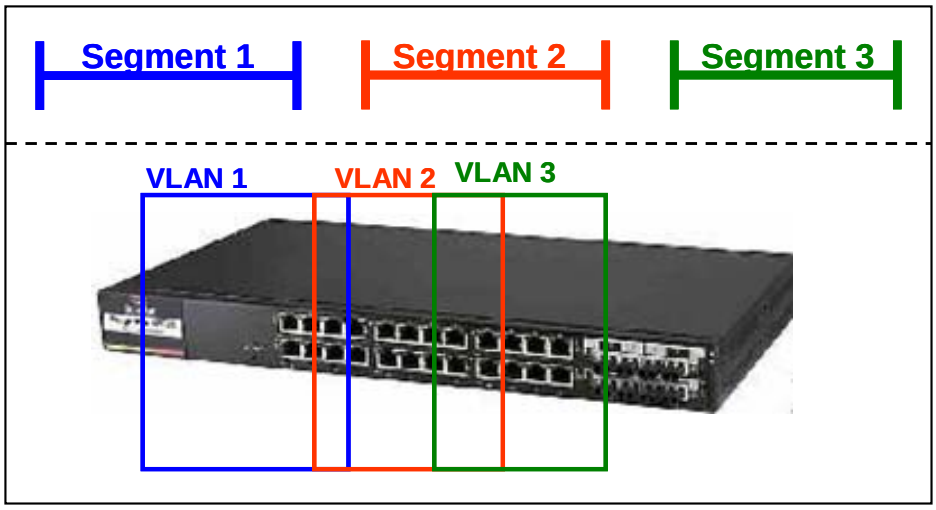
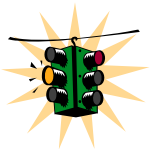


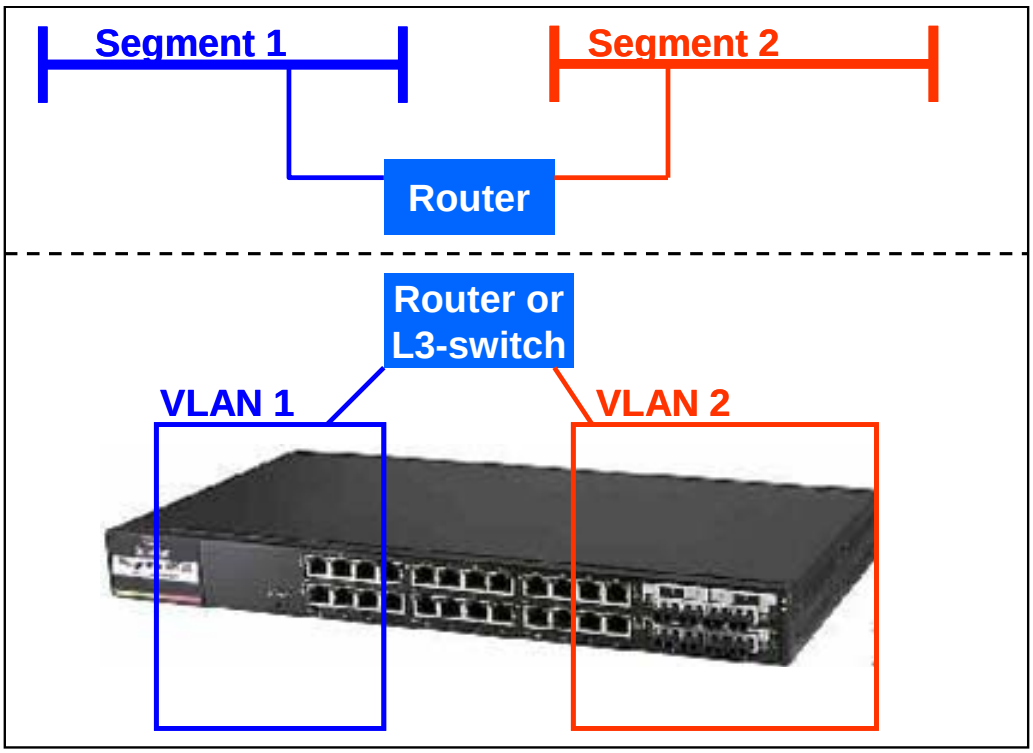
FIGURE 79 – *Ports can belong to multiple VLANs. In this figure a simplistic view is presented where some ports belong to VLANs 1, 2 and other ports belong to VLANs 2,3. Ports can belong to VLANs 1, 2 and 3. This is not shown in the figure.*



By default, on Magnum 6K family of switches, VLAN support is disabled and all ports on the switch belong to the default VLAN (DEFAULT-VLAN). This places all ports on the switch into one physical broadcast domain.

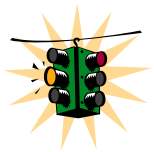
Users familiar with VLANs and plan to deploy GarrettCom switches to interoperate with Cisco™ switches, should download the Tech Briefs on how to configure VLANs to interoperate with a Cisco switch. These are available on the GarrettCom web (under Resources and Support → Software → Tech Briefs)

If VLANs are entirely separate segments or traffic domains – how can the VLANs route traffic (or "talk") to each other? This can be done using routing technologies (e.g., a router or a L3-switch). The routing function can be done internally to a L3-switch. One advantage of an L3 switch is that the switch can also support multiple VLANs. The L3 switch can thus route traffic across multiple VLANs easily and provides a cost effective solution if there are mnay VLANs defined.



MNS-6K-SECURE supports up to 256 VLANs.

FIGURE 80 – *routing between different VLANs is performed using a router such as a Magnum DX device or a Layer 3 switch (L3-switch)*



MNS-6K supports up to 32 VLANs per switch. MNS-6K-SECURE supports up to 256 VLANs per switch.

Creating VLANs

Creating VLAN and to configure VLAN related commands

Syntax **set vlan type=<tag|none>** - *define the VLANs or set all VLANs to default VLAN*

VLAN Configuration

Syntax **vlan** - *enter the VLAN configuration menus*

Adding VLANs

Syntax **add id=<vlan Id> [name=<vlan name>] port=<number|list|range> [forbid=<number|list|range>] [<mgt|nomgt>]**

Disabling Management on VLAN

Use the <nomgt> option when creating a VLAN as shown in the add id command above.

Starting VLANs

Syntax **start vlan=<name|number|list|range>**

Saving the configuration

Syntax **save**

Editing VLANs

Syntax **edit id=<vlan Id> [name=<vlan name>] port=<number|list|range> [<mgt|nomgt>]**

Displaying the VLAN information

Syntax **show vlan [<id=vlanid>] [port=<number|list|range>]**

```
Magnum6K25#vlan

Magnum6K25(tag-vlan)## add id=2 name=test port=1-10

Magnum6K25(tag -vlan)## start vlan=all

Magnum6K25(tag -vlan)## save

Saving current configuration...
Configuration saved
```

FIGURE 81 – *configuring VLANs on Magnum 6K switch*

Private VLANs

Private VLANs are VLANs which are private to a given switch in a network. For Magnum 6K family of switches, the Private VLANs are usually restricted to a single switch. Private VLANs are implemented on Magnum 6K family of switches using Port based VLAN. See the section on Port VLAN for additional information.

The reasons Private VLANs are constructed are for security. For example, if some confidential data were residing on VLAN 5, then only the people connected to that switch on VLAN 5 can

have access to that information. No one else can access that VLAN. Similarly, if another switch had video surveillance equipment on VLAN 20 then only ports with access to VLAN 20 can have access to the video surveillance information.

Finally, one port can belong to multiple VLANs – so depending on the function and use, different VLANs information can be shared across a port. Such a port is said to be in promiscuous mode for private VLANs.

Using VLANs

When multiple switches are connected on a network, the VLAN information needs to be propagated on to other switches. In such situations – it is best to use tag based VLANs.

The commands for setting VLANs are

Syntax **set-port port=<number|list|range> default id=<number>** *sets the default VLAN id (termed PVID in previous versions). Default VLAN id is the VLAN id assigned to the untagged packets received on that port. For Magnum 6K family of switches, the default VLAN id is 1*

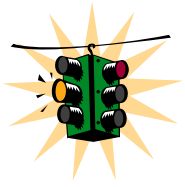
Syntax **set-port port=<number|list|range> filter status=<enable|disable>** *enables or disables the VLAN filtering function. When enabled, the switch will drop the packets coming in through a port if the port is not a member of the VLAN. For example, if port 1 is a member of VLANs 10, 20 and 30, if a packet with VLAN id 40 arrives at port 1 it will be dropped*

Syntax **set-port port=<number|list|range> tagging id=<number> status=<tagged|untagged>** *defines whether the outgoing packets from a port will be tagged or untagged. This definition is on a per VLAN basis. For example the command* ***set-port port=1 tagging id=10 status=tagged*** *will instruct the switch to tag all packets going out of port 1 to belong to VLAN 10*

Syntax **set-port port=<number|list|range> join id=<number>** *adds the specified port(s) to the specified VLAN id. This command works with active or pending VLANs*

Syntax **set-port port=<number|list|range> leave id=<number>** *releases a specific port from a VLAN. For example if port 1 belongs to VLAN 10, 20, 30, 40 the command* ***set-port port=1 leave id=40*** *makes port 1 belong to VLAN 10, 20, 30, dropping VLAN 40*

Syntax **show-port [port=<port|list|range>]** *shows all parameters related to tag vlan for the list of ports. If the port parameter is omitted, it will display all ports*



In the example below, we start with Port VLAN and convert to TAG VLAN. We define ports 14 through 16 to belong to VLANs 10, 20 and 30 and the rest of the ports belong to the default VLAN – VLAN 1. Filtering is enabled on ports 14-16. The VLAN setup is done before devices are plugged into ports 14-16 as a result the status of the ports show the port status as DOWN.

1. A word of caution – when TAG VLAN filtering is enabled, there can be serious connectivity repercussions – the only way to recover from that it is to reload the switch without saving the configuration or by modifying the configuration from the console (serial) port
2. There can be either TAG VLAN on MSN-6K or Port VLAN. Both VLANs cannot co-exit at the same time
3. There can only be one default VLAN for the switch. The default is set to VLAN 1 and can be changed to another VLAN. A word of caution on changing the default VLAN as well – there can be repercussions on management as well as multicast and other issues
4. Tag VLAN support VLAN ids from 1 to 4096. VLAN ids more than 2048 are reserved for specific purposes and it is recommended they not be used
5. There are a maximum of 32 VLANs per switch which can be defined and supported

```
Magnum6K25# vlan

Magnum6K25(tag-vlan)## show vlan

VLAN ID: 1
Name : Default VLAN
Status : Active

 ========================
  PORT  |      STATUS
 ========================
    9      |       UP
   10     |       DOWN
   11     |       DOWN
   12     |       DOWN
   13     |       UP
   15     |       DOWN
   16     |       DOWN

VLAN ID: 10
Name : engineering
Status : Active

 ========================
  PORT  |      STATUS
 ========================
    14     |       DOWN

VLAN ID: 20
Name : sales
Status : Active

 ========================
  PORT  |      STATUS
 ========================
    14     |       DOWN
```

```
VLAN ID: 30
Name : marketing
Status : Active

 ========================
  PORT   |      STATUS
 ========================
    14      |       DOWN

Magnum6K25(port-vlan)## stop vlan=all

 All active VLAN's stopped.

Magnum6K25(port-vlan)## exit

Magnum6K25# show active-vlan

Tag VLAN is currently active.

Magnum6K25# show vlan

VLAN ID: 1
Name : Default VLAN
Status : Active

-----------------------------------------------------
 PORT    |    MODE         |   STATUS
-----------------------------------------------------
   9       |    UNTAGGED |   UP
  10       |    UNTAGGED |   DOWN
  11       |    UNTAGGED |   DOWN
  12       |    UNTAGGED |   DOWN
  13       |    UNTAGGED |   UP
  14       |    UNTAGGED |   DOWN
  15       |    UNTAGGED |   DOWN
  16       |    UNTAGGED |   DOWN

Magnum6K25# vlan

Magnum6K25(tag-vlan)## add id=10 name=mkt port=14-16

Tag based vlan Added Successfully.
Vlan id     :10
Vlan name   : mkt
Ports       :14-16

Magnum6K25(tag-vlan)## edit id=10 name=engineering port=14-16

 Tag based vlan cannot be edited.
ERROR: Invalid vlan id

Magnum6K25(tag-vlan)## add id=20 name=sales port=14-16
```

If VLANs are already active you may have to stop VLANs to execute commands such as delete VLAN. The command here is used as an example to show how VLANs can be stopped. .

Note – ports 14-16 are "DOWN" – the VLAN configuration is preferably done before devices are plugged in to avoid connectivity repercussions.

The edit command can be used to reset the names or other values

```
Tag based vlan Added Successfully.
Vlan id     :20
Vlan name   : sales
Ports       :14-16

Magnum6K25(tag-vlan)## add id=20 name=marketing port=14-16

ERROR: Duplicate Vlan Id

Magnum6K25(tag-vlan)## add id=30 name=marketing port=14-16

Tag based vlan Added Successfully.
Vlan id     :30
Vlan name   : marketing
Ports       :14-16

Magnum6K25(tag-vlan)## show vlan

VLAN ID: 1
Name : Default VLAN
Status : Active

-----------------------------------------------------
 PORT   |    MODE        |   STATUS
-----------------------------------------------------
   9       |    UNTAGGED |   UP
  10       |    UNTAGGED |   DOWN
  11       |    UNTAGGED |   DOWN
  12       |    UNTAGGED |   DOWN
  13       |    UNTAGGED |   UP
  14       |    UNTAGGED |   DOWN
  15       |    UNTAGGED |   DOWN
  16       |    UNTAGGED |   DOWN

VLAN ID: 10
Name : engineering
Status : Pending

-----------------------------------------------------
 PORT   |    MODE        |   STATUS
-----------------------------------------------------
  14       |    UNTAGGED |   DOWN
  15       |    UNTAGGED |   DOWN
  16       |    UNTAGGED |   DOWN

VLAN ID: 20
Name : sales
Status : Pending

-----------------------------------------------------
 PORT   |    MODE        |   STATUS
-----------------------------------------------------
```

Intentionally done to show the effect of adding a duplicate VLAN.

Note – the VLANs are not started as yet. Adding the VLAN does not start it by default.

```
   14      |    UNTAGGED |   DOWN
   15      |    UNTAGGED |   DOWN
   16      |    UNTAGGED |   DOWN

VLAN ID: 30
Name : marketing
Status : Pending

-----------------------------------------------------
 PORT    |    MODE         |   STATUS
-----------------------------------------------------
   14      |    UNTAGGED |   DOWN
   15      |    UNTAGGED |   DOWN
   16      |    UNTAGGED |   DOWN

Magnum6K25(tag-vlan)## start vlan=all

 All pending VLAN's started.

Magnum6K25(tag-vlan)## set-port port=14-16 filter status=enable

Ingress Filter Enabled
Magnum6K25(tag-vlan)## show vlan

Magnum 6K25(tag-vlan)##show vlan

VLAN ID: 1
Name : Default VLAN
Status : Active

-----------------------------------------------
 PORT |      MODE      |      STATUS
-----------------------------------------------
    1 |       UNTAGGED |        UP
    2 |       UNTAGGED |       DOWN
    3 |       UNTAGGED |       DOWN
    4 |       UNTAGGED |       DOWN
    5 |       UNTAGGED |       DOWN
    6 |       UNTAGGED |       DOWN
    7 |       UNTAGGED |       DOWN
    8 |       UNTAGGED |       DOWN
    9 |       UNTAGGED |       DOWN
   10 |       UNTAGGED |       DOWN
   11 |       UNTAGGED |       DOWN
   12 |       UNTAGGED |       DOWN
   13 |       UNTAGGED |       DOWN
   14 |       UNTAGGED |       DOWN
   15 |       UNTAGGED |       DOWN
   16 |       UNTAGGED |       DOWN

VLAN ID: 10
Name : mkt
Status : Active
```

Enable filtering on the ports required. Note – the MNS-6K software will prompt you to be sure that connectivity is not disrupted.

```
------------------------------------------------
 PORT |      MODE      |      STATUS
------------------------------------------------
   14 |       UNTAGGED |       DOWN
   15 |       UNTAGGED |       DOWN
   16 |       UNTAGGED |       DOWN

VLAN ID: 20
Name : sales
Status : Active

------------------------------------------------
 PORT |      MODE      |      STATUS
------------------------------------------------
   14 |       UNTAGGED |       DOWN
   15 |       UNTAGGED |       DOWN
   16 |       UNTAGGED |       DOWN

VLAN ID: 30
Name : marketing
Status : Active

------------------------------------------------
 PORT |      MODE      |      STATUS
------------------------------------------------
   14 |       UNTAGGED |       DOWN
   15 |       UNTAGGED |       DOWN
   16 |       UNTAGGED |       DOWN
```

These commands sets the ports 14-16 as trunk ports. Note VLAN 1 – the default VLAN is not tagged and will have to be tagged to function as a trunk default VLAN. To filter out a VLAN from the trunk – simply omit the VLAN from the set-port command shown here.

```
Magnum6K25(tag-vlan)## set-port port=14-16 tagging id=10 status=tagged

Port tagging enabled

Magnum6K25(tag-vlan)## set-port port=14-16 tagging id=20 status=tagged

Port tagging enabled

Magnum6K25(tag-vlan)## set-port port=14-16 tagging id=30 status=tagged

Port tagging enabled

Magnum6K25(tag-vlan)## show vlan

VLAN ID: 1
Name : Default VLAN
Status : Active

------------------------------------------------
 PORT |      MODE      |      STATUS
------------------------------------------------
    1 |       UNTAGGED |         UP
```

```
    2 |       UNTAGGED |       DOWN
    3 |       UNTAGGED |       DOWN
    4 |       UNTAGGED |       DOWN
    5 |       UNTAGGED |       DOWN
    6 |       UNTAGGED |       DOWN
    7 |       UNTAGGED |       DOWN
    8 |       UNTAGGED |       DOWN
    9 |       UNTAGGED |       DOWN
   10 |       UNTAGGED |       DOWN
   11 |       UNTAGGED |       DOWN
   12 |       UNTAGGED |       DOWN
   13 |       UNTAGGED |       DOWN
   14 |       UNTAGGED |       DOWN
   15 |       UNTAGGED |       DOWN
   16 |       UNTAGGED |       DOWN

VLAN ID: 10
Name : mkt
Status : Active

-----------------------------------------------
 PORT |      MODE      |      STATUS
-----------------------------------------------
   14 |       TAGGED |       DOWN
   15 |       TAGGED |       DOWN
   16 |       TAGGED |       DOWN

VLAN ID: 20
Name : sales
Status : Active

-----------------------------------------------
 PORT |      MODE      |      STATUS
-----------------------------------------------
   14 |       TAGGED |       DOWN
   15 |       TAGGED |       DOWN
   16 |       TAGGED |       DOWN

VLAN ID: 30
Name : marketing
Status : Active

-----------------------------------------------
 PORT |      MODE      |      STATUS
-----------------------------------------------
   14 |       TAGGED |       DOWN
   15 |       TAGGED |       DOWN
   16 |       TAGGED |       DOWN

Magnum6K25 (tag-vlan)## show-port


VLAN Port Status.
```

Note – ports 14-16 are sending packets out as tagged packets on VLANs 10, 20 and 30 only. VLAN 1 – the default VLAN is untagged. Ports 14-16 also still belong to VLAN 1.

```
  Port   1
    Default ID            :    1
    Filter Status         : DISABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED

  Port   2
    Default ID            :    1
    Filter Status         : DISABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED

<Deleting repeated information for ports 3 through 12>

  Port  13
    Default ID            :    1
    Filter Status         : DISABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED

  Port  14
    Default ID            :    1
    Filter Status         : ENABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED
      Vlan:   10 Status: Pending    TAGGED
      Vlan:   20 Status: Pending    TAGGED
      Vlan:   30 Status: Pending    TAGGED

  Port  15
    Default ID            :    1
    Filter Status         : ENABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED
      Vlan:   10 Status: Pending    TAGGED
      Vlan:   20 Status: Pending    TAGGED
      Vlan:   30 Status: Pending    TAGGED

  Port  16
    Default ID            :    1
    Filter Status         : ENABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED
      Vlan:   10 Status: Pending    TAGGED
      Vlan:   20 Status: Pending    TAGGED
      Vlan:   30 Status: Pending    TAGGED

Magnum6K25(tag-vlan)## vlan enable

VLAN Enabled.

Magnum6K25(tag-vlan)## start vlan=all

 All pending VLAN's started.
```

```
Magnum6K25(tag-vlan)## show-port

VLAN Port Status.

  Port   1
    Default ID            :    1
    Filter Status         : DISABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED

  Port   2
    Default ID            :    1
    Filter Status         : DISABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED

<Deleting repeated information for ports 3 through 12>

  Port  13
    Default ID            :    1
    Filter Status         : DISABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED

  Port  14
    Default ID            :    1
    Filter Status         : ENABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED
      Vlan:   10 Status:  Active     TAGGED
      Vlan:   20 Status:  Active     TAGGED
      Vlan:   30 Status:  Active     TAGGED

Port  15
    Default ID            :    1
    Filter Status         : ENABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED
      Vlan:   10 Status:  Active     TAGGED
      Vlan:   20 Status:  Active     TAGGED
      Vlan:   30 Status:  Active     TAGGED

  Port  16
    Default ID            :    1
    Filter Status         : ENABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED
      Vlan:   10 Status:  Active     TAGGED
      Vlan:   20 Status:  Active     TAGGED
      Vlan:   30 Status:  Active     TAGGED

Magnum6K25(tag-vlan)## show-port port=14
```

```
VLAN Port Status.

  Port  14
    Default ID            :    1
    Filter Status         : ENABLED.
    VLAN Memberships:
      Vlan:    1 Status:  Active   UNTAGGED
      Vlan:   10 Status:  Active     TAGGED
      Vlan:   20 Status:  Active     TAGGED
      Vlan:   30 Status:  Active     TAGGED
```

In the above example, "show-port" command provides a perspective on which VLANs are associated with which ports, whether the VLANs are active, tagged or untagged. While the above instructions are illustrative of how the commands are used, it is recommended to download the tech briefs on how to configure VLAN on MNS-6K using Cisco Catalyst® switches or Magnum DX routers. These tech briefs are available on the GarrettCom Inc. web site www.garrettcom.com – under Resources and Support → Software Support. On that page, look for the drop down on "Technical Briefs"

List of commands in this chapter

Syntax **set vlan type=<tag|none>** *defines the VLAN type*

Syntax **vlan <enable|disable>** *- allow VLAN commands or configure vlan commands*

Syntax **vlan** – *enter the subset of VLAN commands*

Syntax **add id=<vlan Id> [name=<vlan name>] port=<number|list|range> [forbid=<number|list|range>] [<mgt|nomgt>] -** *adding VLAN*

Syntax **start vlan=<name|number|list|range>** *activate the VLAN configuration*

Syntax **save** *save the configuration (including the VLAN configuration)*

Syntax **edit id=<vlan id> [name=<vlan name>] port=<number|list|range> [<mgt|nomgt>] -** *edit existing VLAN name*

Syntax **show vlan [<id=vlanid>]** *display specific VLAN information*

Syntax **set-port port=<number|list|range> default id=<number>** *sets the default VLAN id. For Magnum 6K family of switches, the default VLAN id is 1, unless changed using this command*

Syntax **set-port port=<number|list|range> filter status=<enable|disable>** *enables or disables the VLAN filtering function.*

Syntax **set-port port=<number|list|range> tagging id=<number> status=<tagged|untagged>** *defines whether the outgoing packets from a port will be tagged or untagged.*

Syntax **set-port port=<number|list|range> join id=<number>** *adds the specified port(s) to the specified VLAN id*

Syntax **set-port port=<number|list|range> leave id=<number>** *releases a specific port from a VLAN*

Syntax **show-port [port=<port|list|range>]** *shows all parameters related to tag vlan for the list of ports. If the port parameter is omitted, it will display all ports*

Chapter 12

12 – Spanning Tree Protocol (STP)

Create and manage alternate paths to the network

Spanning Tree Protocol was designed to avoid loops in an Ethernet network. An Ethernet network using switches can have redundant paths – this may however cause loops and to prevent the loops MNS-6K software uses spanning tree protocol. As a manager of the MNS-6K software, controlling n which span the traffic traverses is necessary. It is also necessary to specify the parameters of STP. STP is available as the IEEE 802.1d protocol and is a standard of the IEEE.

STP features and operation

The switch uses the IEEE 802.1d Spanning Tree Protocol (STP). When STP is enabled, it ensures that only one path at a time is active between any two nodes on the network. In networks where more than one physical path exists between two nodes, STP ensures only a single path is active by blocking all redundant paths. Enabling STP is necessary to avoid loops and duplicate messages. This duplication leads to a "broadcast storm" or other erratic behavior that can bring down the network.

As recommended in the IEEE 802.1Q VLAN standard, the Magnum 6K family of switches uses **single-instance STP**. This means a single spanning tree is created to make sure there are no network loops associated with any of the connections to the switch. This works regardless of whether VLANs are configured on the switch. Thus, these switches do not distinguish between VLANs when identifying redundant physical links.

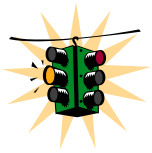
The switch automatically senses port identity and type, and automatically defines port cost and priority for each type. The MNS-6K software allows a manager to adjust the cost, priority, the mode for each port as well as the global STP parameter values for the switch.

While allowing only one active path through a network at any time, STP retains any redundant physical path to serve as a backup (blocked) path in case the existing active path fails. Thus, if an active path fails, STP automatically activates (unblocks) an available backup to serve as the new active path for as long as the original active path is down.

The table below lists the default values of the STP variables.

Variable or Attribute	Default Value
STP capabilities	Disabled
reconfiguring general operation priority	32768
Bridge maximum age	20 seconds
Hello time	2 seconds
Forward delay	15 seconds
Reconfiguring per-port STP path cost	0
Priority	32768
Mode	Normal
Monitoring of STP	Not Available
Root Port	Not set

Figure 82 – *STP default values – refer to next section "Using STP" for more detailed explanation on the variables*



1. By default, STP is disabled. To use STP, it has to be manually enabled

2. If you are using tagged VLANs, at least one untagged VLAN must be available for the BPDU's to propagate through the network to update STP status

3. Whenever changes are made to STP, it is recommended to disable and enable STP to ensure the changes are effective

Using STP

The commands used for configuring STP are listed below.

Syntax **show stp <config|ports> -** *regardless of whether STP is enabled or disabled (default) this command lists the switch's full STP configuration, including general settings and port settings*

```
Magnum6K25# show stp config

 STP CONFIGURATION
 ----------------
 Spanning Tree Enabled(Global)    :  NO
 Spanning Tree Enabled(Ports)     :  YES, 9,10,11,12,13,14,15,16
 Protocol                         : Normal STP
```

```
Bridge ID                       : 80:00:00:20:06:25:ed:80
Bridge Priority                 : 32768
Bridge Forward Delay            : 15
Bridge Hello Time               : 2
Bridge Max Age                  : 20
Root Port                       : 0
Root Path Cost                  : 0
Designated Root                 : 80:00:00:20:06:25:ed:80
Designated Root Priority        : 32768
Root Bridge Forward Delay       : 15
Root Bridge Hello Time          : 2
Root Bridge Max Age             : 20

RSTP CONFIGURATION
-----------------
Rapid STP/STP Enabled(Global)   : NO
Magnum6K25#
```

FIGURE 83 – *Viewing STP configuration*

The variables listed above are:
Spanning Tree Enabled (Global): indicates whether STP is enabled or disabled globally i.e. if the values is YES, all ports have STP enabled, otherwise, all ports have STP disabled

Spanning Tree Enabled (Ports): indicates which ports have STP enabled – note in the figure the ports 9 through 16 are STP enabled, but STP functionality is not enabled – so STP will not perform on these ports

Bridge Priority: specifies the switch (bridge) priority value. This value is used along with the switch MAC address to determine which switch in the network is the root device. Lower values mean higher priority. Value ranges from 0 to 65535. Default value is 32768

Bridge Forward Delay: indicates the time duration the switch will wait from listening to learning states and from learning to forwarding states. The value ranges from 4 to 30 seconds. Default value is 15

Bridge Hello Time: When the switch is the root device, this is the time between messages being transmitted. The value is from 1 to 10 seconds. Default value is 2 seconds

Bridge Max Age: This is the maximum time a message with STP information is allowed by the switch before the switch discards the information and updates the address table again. Value ranges from 6 to 40 seconds with default value of 20 seconds

Root Port: indicates the port number, which is elected as the root port of the switch. A root port of "0" indicates STP is disabled

Root Path Cost: A path cost is assigned to individual ports for the switch to determine which ports are the forwarding points. A higher cost means more loops, a lower cost means fewer loops. More loops equal more traffic and a tree which takes a long time to converge – resulting in a slower system

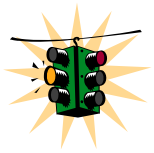
Designated Root: shows the MAC address of the bridge in the network elected or designated as the root bridge. Normally when STP is not enabled the switch designates itself as the root switch

Designated Root Priority: shows the designated root bridge's priority. Default value is 32768

Root Bridge Forward Delay: indicates the designated root bridge's forward delay. This is the time the switch waits before it switches from the listening to the forwarding state. The default is 15 seconds. This value can be set between 4-30 seconds

Root Bridge Hello Time: indicates the designated root bridge's hello time. Hello information is sent out every 2 seconds

Root Bridge Max Age: indicates the designated root bridge's maximum age – after which it discards the information as being old and receives new updates



These variables can be changed using the "priority", "cost", "port" and "timers" commands described later in this chapter.

Magnum6K25# show stp ports

STP Port Configuration

Port#	Type	Priority	Path Cost	State	Des. Bridge	Des. Port
09	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:09
10	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0a
11	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0b
12	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0c
13	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0d
14	TP(10/100	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0e
15	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0f
16	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:10

Magnum6K25#

FIGURE 84 – *STP Port status information*

The variables shown above are
Port#: indicates the port number. Value ranges from 01 to max number of ports in the switch

Type: indicates the type of port – TP indicates Twisted Pair

Priority: STP uses this to determine which ports are used for forwarding. Lower the number means higher priority. Value ranges from 0 to 255. Default is 128

Path Cost: This is the assigned port cost value used for the switch to determine the forwarding points. Values range from 1 to 65535

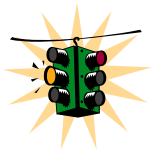
State: indicates the STP state of individual ports. Values can be Listening, Learning, Forwarding, Blocking and Disabled.

Des. Bridge: This is the port's designated root bridge

Des. Port: This is the port's designated root port

To enable or disable STP, enter the STP configuration mode and use the "**stp <enable|disable>**" command.

Syntax **stp** – *STP Configuration mode*
Syntax **stp <enable|disable>** *- Start (Enable) or stop (Disable) STP*
Syntax **set stp type=<stp|rstp>** *- set the spanning tree protocol to be IEEE 802.1d or 802.1w (Rapid Spanning Tree Protocol)*
Syntax **show active-stp** – *Display which version of STP is currently active*



Incorrect STP settings can adversely affect network performance. GarrettCom Inc. recommends starting with the default STP settings. Changing the settings requires a detailed understanding of STP. For more information on STP, please refer to the IEEE 802.1d standard.

```
Magnum6K25# show active-stp

 Current Active Mode: RSTP.
 RSTP is Disabled.

Magnum6K25# stp

ERROR: Invalid Command

Magnum6K25#set stp type=stp

 STP Mode set to STP.

Magnum6K25# stp

Magnum6K25(stp)## stp enable
Successfully set the STP status

Magnum6K25(stp)## show stp config
```

Note –it is always a good idea to check which mode of STP is active. If the proper mode is not active, the configuration command "stp" will not be understood. To set the proper mode, use the "set stp" command.

```
STP CONFIGURATION
-----------------
Spanning Tree Enabled(Global)  :  YES
Spanning Tree Enabled(Ports)   :  YES, 9,10,11,12,13,14,15,16
Protocol                       : Normal STP
Bridge ID                      :  80:00:00:20:06:25:ed:80
Bridge Priority                :  32768
Bridge Forward Delay           :  15
Bridge Hello Time              :  2
Bridge Max Age                 :  20
Root Port                      :  0
Root Path Cost                 :  0
Designated Root                :  80:00:00:20:06:25:ed:80
Designated Root Priority       :  32768
Root Bridge Forward Delay      :  15
Root Bridge Hello Time         :  2
Root Bridge Max Age            :  20

RSTP CONFIGURATION
-----------------
Rapid STP/STP Enabled(Global) : NO

Magnum6K25(stp)## show stp ports

STP Port Configuration
-------------------------------------------------------------------------------------------------------------------
Port#  Type          Priority  Path Cost  State       Des. Bridge                Des. Port
-------------------------------------------------------------------------------------------------------------------
09     TP(10/100)    128       100        Forwarding  80:00:00:20:06:25:ed:80    80:09
10     TP(10/100)    128       100        Disabled    80:00:00:20:06:25:ed:80    80:0a
11     TP(10/100)    128       100        Disabled    80:00:00:20:06:25:ed:80    80:0b
12     TP(10/100)    128       100        Disabled    80:00:00:20:06:25:ed:80    80:0c
13     TP(10/100)    128       19         Forwarding  80:00:00:20:06:25:ed:80    80:0d
14     TP(10/100     128       100        Disabled    80:00:00:20:06:25:ed:80    80:0e
15     TP(10/100)    128       100        Disabled    80:00:00:20:06:25:ed:80    80:0f
16     TP(10/100)    128       100        Disabled    80:00:00:20:06:25:ed:80    80:10

Magnum6K25(stp)##
```

FIGURE 85 – *Enabling STP*

Syntax **priority [port=<number|list|range>] value=<0-255 | 0-65535> -** *specifies the port or switch level priority. When a port(s) are specified the priority is associated with ports and their value is 0-255. If no ports are specified, then the switch (bridge) priority is specified and its value is 0-65535*

Syntax **cost port=<number|list|range> value=<0-65535>** *- cost is specific to a port and the port(s) have to be specified*

Syntax **port port=<number|list|range> status=<enable|disable>** *- specific ports may not need to participate in STP process. These ports typically would be end-stations. If you are not sure – let MNS-6K software make the decisions*

Syntax **timers forward-delay=<4-30> hello=<1-10> age=<6-160>** *- change the STP Forward Delay, Hello timer and Aging timer values*

Priority: specifies the switch (bridge) priority value. This value is used along with the switch MAC address to determine which switch in the network is the root device. Lower values mean higher priority. Value ranges from 0 to 65535. Default value is 32768

Cost: A path cost is assigned to individual ports for the switch to determine which ports are the forwarding points. A higher cost means the link is "more expensive" to use and falls in the passive mode compared to the link with a lower cost. Value ranges from 0 to 65535. Default value is 32768

Status: Enables or disables a port from participating in STP discovery. Its best to only allow trunk ports to participate in STP. End stations need not participate in STP process.

Forward-Delay: indicates the time duration the switch will wait from listening to learning states and from learning to forwarding states. The value ranges from 4 to 30 seconds. Default value is 15

Hello: When the switch is the root device, this is the time between messages being transmitted. The value is from 1 to 10 seconds. Default value is 2 seconds

Age: This is the maximum time a message with STP information is allowed by the switch before the switch discards the information and updates the address table again. Value ranges from 6 to 40 seconds with default value of 20 seconds

```
Magnum6K25(stp)## show stp config

 STP CONFIGURATION
 -----------------
 Spanning Tree Enabled(Global)    : NO
 Spanning Tree Enabled(Ports)     : YES, 9,10,11,12,13,14,15,16
 Protocol                         : Normal STP
 Bridge ID                        : 80:00:00:20:06:25:ed:80
 Bridge Priority                  : 32768
 Bridge Forward Delay             : 15
 Bridge Hello Time                : 2
 Bridge Max Age                   : 20
 Root Port                        : 0
 Root Path Cost                   : 0
 Designated Root                  : 80:00:00:20:06:25:ed:80
 Designated Root Priority         : 32768
 Root Bridge Forward Delay        : 15
 Root Bridge Hello Time           : 2
 Root Bridge Max Age              : 20

 RSTP CONFIGURATION
 -----------------
 Rapid STP/STP Enabled(Global)    : NO

Magnum6K25(stp)## show stp ports
```

STP Port Configuration

Port#	Type	Priority	Path Cost	State	Des. Bridge	Des. Port
09	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:09
10	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0a
11	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0b
12	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0c
13	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0d
14	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0e
15	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0f
16	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:10

Magnum6K25(stp)## stp enable
Successfully set the STP status

Magnum6K25(stp)## show stp config

STP CONFIGURATION

Spanning Tree Enabled(Global)	:	YES
Spanning Tree Enabled(Ports)	:	YES, 9,10,11,12,13,14,15,16
Protocol	:	Normal STP
Bridge ID	:	80:00:00:20:06:25:ed:80
Bridge Priority	:	32768
Bridge Forward Delay	:	15
Bridge Hello Time	:	2
Bridge Max Age	:	20
Root Port	:	0
Root Path Cost	:	0
Designated Root	:	80:00:00:20:06:25:ed:80
Designated Root Priority	:	32768
Root Bridge Forward Delay	:	15
Root Bridge Hello Time	:	2
Root Bridge Max Age	:	20

RSTP CONFIGURATION

Rapid STP/STP Enabled(Global) : NO

Ports which have devices connected to it now participate in STP.

Magnum6K25(stp)## show stp ports

STP Port Configuration

Port#	Type	Priority	Path Cost	State	Des. Bridge	Des. Port
09	TP(10/100)	128	100	Forwarding	80:00:00:20:06:25:ed:80	80:09
10	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0a
11	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0b
12	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0c
13	TP(10/100)	128	19	Forwarding	80:00:00:20:06:25:ed:80	80:0d

```
14      TP(10/100)  128        100      Disabled    80:00:00:20:06:25:ed:80    80:0e
15      TP(10/100)  128        100      Disabled    80:00:00:20:06:25:ed:80    80:0f
16      TP(10/100)  128        100      Disabled    80:00:00:20:06:25:ed:80    80:10
```

Magnum6K25(stp)## **priority value=15535**

Successfully set the bridge priority

Magnum6K25(stp)## **show stp config**

STP is now enabled. Note the default values for the different variables discussed.

```
 STP CONFIGURATION
  -----------------
  Spanning Tree Enabled(Global)     : YES
  Spanning Tree Enabled(Ports)      : YES, 9,10,11,12,13,14,15,16
  Protocol                          : Normal STP
  Bridge ID                         : 80:00:00:20:06:25:ed:80
  Bridge Priority                   : 15535
  Bridge Forward Delay              : 15
  Bridge Hello Time                 : 2
  Bridge Max Age                    : 20
  Root Port                         : 0
  Root Path Cost                    : 0
  Designated Root                   : 80:00:00:20:06:25:ed:80
  Designated Root Priority          : 15535
  Root Bridge Forward Delay         : 15
  Root Bridge Hello Time            : 2
  Root Bridge Max Age               : 20

  RSTP CONFIGURATION
  -----------------
  Rapid STP/STP Enabled(Global)     : NO
```

Magnum6K25(stp)## **priority port=13 value=20**
Successfully set the priority for port 13

Magnum6K25(stp)## **show stp ports**

Note on Port #13, the priority changed, however the Path Cost did not – till the cost command is issued.

STP Port Configuration

```
Port#   Type        Priority  Path Cost  State       Des. Bridge                Des. Port
09      TP(10/100)  128        100      Forwarding  80:00:00:20:06:25:ed:80    80:09
10      TP(10/100)  128        100      Disabled    80:00:00:20:06:25:ed:80    80:0a
11      TP(10/100)  128        100      Disabled    80:00:00:20:06:25:ed:80    80:0b
12      TP(10/100)  128        100      Disabled    80:00:00:20:06:25:ed:80    80:0c
13      TP(10/100)   20         19      Forwarding  80:00:00:20:06:25:ed:80    80:0d
14      TP(10/100)  128        100      Disabled    80:00:00:20:06:25:ed:80    80:0e
15      TP(10/100)  128        100      Disabled    80:00:00:20:06:25:ed:80    80:0f
16      TP(10/100)  128        100      Disabled    80:00:00:20:06:25:ed:80    80:10
```

Magnum6K25(stp)## **cost port=13 value=20**

Setting cost for STP...Successfully set the path cost for port 13

Magnum6K25(stp)## show stp ports

STP Port Configuration

Port#	Type	Priority	Path Cost	State	Des. Bridge	Des. Port
09	TP(10/100)	128	100	Forwarding	80:00:00:20:06:25:ed:80	80:09
10	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0a
11	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0b
12	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0c
13	TP(10/100)	20	20	Forwarding	80:00:00:20:06:25:ed:80	80:0d
14	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0e
15	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0f
16	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:10

Magnum6K25(stp)## port port=9 status=disable

Successfully set the STP status for port 9

Magnum6K25(stp)## show stp ports

Since Port #9 does not participate in STP – it is not listed here. Any changes made to STP parameters on Port #9 will be ignored.

STP Port Configuration

Port#	Type	Priority	Path Cost	State	Des. Bridge	Des. Port
10	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0a
11	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0b
12	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0c
13	TP(10/100)	20	19	Forwarding	80:00:00:20:06:25:ed:80	80:0d
14	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0e
15	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0f
16	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:10

Magnum6K25(stp)## port port=9 status=enable

Successfully set the STP status for port 9

Magnum6K25(stp)## show stp ports

STP Port Configuration

Port#	Type	Priority	Path Cost	State	Des. Bridge	Des. Port
09	TP(10/100)	128	100	Forwarding	80:00:00:20:06:25:ed:80	80:09
10	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0a
11	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0b
12	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0c
13	TP(10/100)	20	20	Forwarding	80:00:00:20:06:25:ed:80	80:0d
14	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0e
15	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:0f
16	TP(10/100)	128	100	Disabled	80:00:00:20:06:25:ed:80	80:10

```
Magnum6K25(stp)## show stp config

 STP CONFIGURATION
  ----------------
  Spanning Tree Enabled(Global)    : YES
  Spanning Tree Enabled(Ports)     : YES, 9,10,11,12,13,14,15,16
  Protocol                         : Normal STP
  Bridge ID                        : 80:00:00:20:06:25:ed:80
  Bridge Priority                  : 15535
  Bridge Forward Delay             : 15
  Bridge Hello Time                : 2
  Bridge Max Age                   : 20
  Root Port                        : 0
  Root Path Cost                   : 0
  Designated Root                  : 80:00:00:20:06:25:ed:80
  Designated Root Priority         : 15535
  Root Bridge Forward Delay        : 15
  Root Bridge Hello Time           : 2
  Root Bridge Max Age              : 20

  RSTP CONFIGURATION
  ----------------
  Rapid STP/STP Enabled(Global)    : NO
```

The age parameter is out of range as per IEEE 802.1d specifications.

```
Magnum6K25(stp)## timers forward-delay=20 hello=5 age=40

  ERROR:  Invalid Values
        Max Age <= (2*(Forward-Delay-1)) and Max Age >= (2*(Hello-Time+1))

Magnum6K25(stp)## timers forward-delay=20 hello=5 age=30

Successfully set the bridge time parameters

Magnum6K25(stp)## show stp config

STP CONFIGURATION
  ----------------
  Spanning Tree Enabled(Global)    : YES
  Spanning Tree Enabled(Ports)     : YES, 9,10,11,12,13,14,15,16
  Protocol                         : Normal STP
  Bridge ID                        : 80:00:00:20:06:25:ed:80
  Bridge Priority                  : 15535
  Bridge Forward Delay             : 20
  Bridge Hello Time                : 5
  Bridge Max Age                   : 30
  Root Port                        : 0
  Root Path Cost                   : 0
  Designated Root                  : 80:00:00:20:06:25:ed:80
  Designated Root Priority         : 15535
  Root Bridge Forward Delay        : 20
  Root Bridge Hello Time           : 5
  Root Bridge Max Age              : 30
```

```
RSTP CONFIGURATION
-----------------
Rapid STP/STP Enabled(Global)    : NO


Magnum6K25(stp)##
```

FIGURE 86 – *Configuring STP parameters*

List of commands in this chapter

Syntax **show stp <config|ports > -** *regardless of whether STP is enabled or disabled (default) this command lists the switch's full STP configuration, including general settings and port settings*

Syntax **stp** – *STP Configuration mode*

Syntax **stp <enable|disable>** *- Start (Enable) or stop (Disable) STP*

Syntax **priority [port=<number|list|range>] value=<0-255 | 0-65535> -** *specifies the port or switch level priority. When a port(s) are specified the priority is associated with ports and their value is 0-255. If no ports are specified, then the switch (bridge) priority is specified and its value is 0-65535*

Syntax **cost port=<number|list|range> value=<0-65535>** *- cost is specific to a port and the port(s) have to be specified*

Syntax **port port=<number|list|range> status=<enable|disable>** *- specific ports may not need to participate in STP process. These ports typically would be end-stations. If you are not sure – let MNS-6K software make the decisions*

Syntax **timers forward-delay=<4-30> hello=<1-10> age=<6-160>** *- change the STP Forward Delay, Hello timer and Aging timer values*

Chapter

13

13 – Rapid Spanning Tree Protocol (RSTP)

Create and manage alternate paths to the network

Rapid Spanning Tree Protocol (RTSP), like STP, was designed to avoid loops in an Ethernet network. Rapid Spanning Tree Protocol (RSTP) (IEEE 802.1w) is an evolution of the Spanning Tree Protocol (STP) (802.1d standard) and provides for faster spanning tree convergence after a topology change.

RSTP concepts

The IEEE 802.1d Spanning Tree Protocol (STP) was developed to allow the construction of robust networks that incorporate redundancy while pruning the active topology of the network to prevent loops. While STP is effective, it requires that frame transfer must halt after a link outage. This halt is until all bridges in the network are sure to be aware of the new topology. Using STP (IEEE 802.1d) recommended values, this period lasts 30 seconds.

Rapid Spanning Tree Protocol (IEEE 802.1w) is a further evolution of the 802.1d Spanning Tree Protocol. It replaces the settling period with an active handshake between switches (bridges) that guarantees topology information to be rapidly propagated through the network. IEEE 802.1D-2004 proposes a new standard for faster recovery for up to 16 switches. GarrettCom implements the IEEE 802.1D-2004 and enhancements to cover more than 16 switches for larger networks. RSTP converges in less than one second to six seconds. RSTP also offers a number of other significant innovations. These include

- Topology changes in STP must be passed to the root bridge before they can be propagated to the network. Topology changes in RSTP can be originated from and acted upon by any designated switch (bridge), leading to more rapid propagation of address information
- STP recognizes one state - blocking for ports that should not forward any data or information. RSTP explicitly recognizes two states or blocking roles - alternate and backup port including them in computations of when to learn and forward and when to block

- STP relays configuration messages received on the root port going out of its designated ports. If an STP switch (bridge) fails to receive a message from its neighbor it cannot be sure where along the path to the root a failure occurred. RSTP switches (bridges) generate their own configuration messages, even if they fail to receive one from the root bridge. This leads to quicker failure detection
- RSTP offers edge port recognition, allowing ports at the edge of the network to forward frames immediately after activation while at the same time protecting them against loops
- An improvement in RSTP allows configuration messages to age more quickly preventing them from "going around in circles" in the event of a loop

RSTP has three states. They are discarding, learning and forwarding.

The discarding state is entered when the port is first taken into service. The port does not learn addresses in this state and does not participate in frame transfer. The port looks for STP traffic in order to determine its role in the network. When it is determined that the port will play an active part in the network, the state will change to learning. The learning state is entered when the port is preparing to play an active member of the network. The port learns addresses in this state but does not participate in frame transfer. In a network of RSTP switches (bridges) the time spent in this state is usually quite short. RSTP switches (bridges) operating in STP compatibility mode will spend between 6 to 40 seconds in this state. After 'learning' the bridge will place the port in the forwarding state. While in this state the port both learns addresses and participates in frame transfer while in this state.

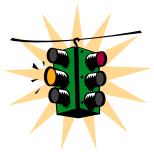
The result of these enhanced states is that the IEEE 802.1d version of spanning tree (STP) can take a fairly long time to resolve all the possible paths and to select the most efficient path through the network. The IEEE 802.1w Rapid reconfiguration of Spanning Tree significantly reduces the amount of time it takes to establish the network path. The result is reduced network downtime and improved network robustness. In addition to faster network reconfiguration, RSTP also implements greater ranges for port path costs to accommodate the higher connection speeds that are being implemented.

Proper implementations of RSTP (by switch vendors) is designed to be compatible with IEEE 802.1d STP. GarrettCom recommends that you employ RSTP or STP in your network.

Transition from STP to RSTP

IEEE 802.1w RSTP is designed to be compatible with IEEE 802.1D STP. Even if all the other devices in your network are using STP, you can enable RSTP on your Magnum 6K family of switches. The default configuration values of the RSTP available in MNS-6K software will ensure that your switch will interoperate effectively with the existing STP devices. RSTP automatically detects when the switch ports are connected to non-RSTP devices using spanning tree and communicates with those devices using 802.1d STP BPDU packets.

Even though RSTP interoperates with STP, RSTP is so much more efficient at establishing the network path and the network convergence in case of a failure is very fast. For this reason, GarrettCom recommends that all your network devices be updated to support RSTP. RSTP offers convergence times typically of less than one second. However, to make best use of RSTP and achieve the fastest possible convergence times there are some changes that you should make to the RSTP default configuration.



1. GarrettCom Inc. provides downloadable software Fault Timing Analyzer (FTA) for testing how quickly a network recovers from a fault, once the redundancy feature such as STP or RSTP is configured on the switches (bridges). This software can be downloaded from the GarrettCom site. This software is available at http://www.garrettcom.com/ftaform.htm
2. Under some circumstances it is possible for the rapid state transitions employed by RSTP to result in an increase in the rates of frame duplication and the order in which the frames are sent and received. In order to allow RSTP switches to support applications and protocols that may be sensitive to frame duplication and out of sequence frames, RSTP may have to be explicitly set to be compatible with STP. This explicit setting is called setting the "Force Protocol Version" parameter to be STP compatible**.** This parameter should be set to all ports on a given switch
3. As indicated above, one of the benefits of RSTP is the implementation of a larger range of port path costs which accommodates higher network speeds. New default values have also been implemented for the path costs associated with the different network speeds. This could create incompatibility between devices running the older implementations of STP a switch running RSTP
4. If you are using tagged VLANs, at least one untagged VLAN must be available for the BPDU's to propagate through the network to update STP status
5. **Whenever changes are made to RSTP, it is recommended to disable and enable RSTP to ensure the changes are effective**

Configuring RSTP

The commands to setup and configure RSTP on MNS-6K are

Syntax **set stp type=<stp|rstp> -** *Set the switch to support RSTP or change it back to STP. Need to save and reboot the switch after this command*

Syntax **rstp** – *enter the RSTP configuration mode*

Syntax **rstp <enable|disable>** *- enable RSTP – by default, this is disabled and has to be manually activated*

Syntax **port port=<number|list|range> [status=<enable|disable>] [migration=<enable>] [edge=<enable|disable>] [p2p=<on|off|auto>]**

Example **port port=<number|list|range> p2p= off -** *Set the "point-to-point" value to off on all ports that are connected to* ***shared LAN segments*** *(i.e. connections to hubs). The default value is auto. P2P ports would typically be end stations or computers on the network*

Example **port port=<number|list|range> edge=enable** – *enable all ports connected to other hubs, bridges and switches as edge ports*

Example **port port=<number|list|range> migration=enable** – *set this for all ports connected to other devices such as hubs, bridges and switches known to support IEEE 802.1d STP services, but cannot support RSTP services*

p2p - This parameter is used to tell the port if it is connected to another switch or a hub or a bridge device. This parameter should be set to **off** for all ports that are connected to a shared device such as a hub. GarrettCom Inc. recommends setting this parameter to auto so that MNS-6K will automatically set the proper value for the network

edge – this parameter is used to tell if the port is connected to an edge device such as a computer or other such device. Disable this feature for a port connected to another device such as a switch, bridge or a hub.

Syntax **show active-stp** – *status whether STP or RSTP is running*

Syntax **show rstp <config|ports>** – *display the RSTP or STP parameters*

```
Magnum6K25# rstp

Magnum6K25(rstp)## show rstp config

 RSTP CONFIGURATION
 -----------------
 Rapid STP/STP Enabled(Global) : NO

Magnum6K25(rstp)## rstp enable

Successfully set the RSTP status

Magnum6K25(rstp)## show active-stp

 Current Active Mode: RSTP.
 RSTP is Enabled.

Magnum6K25(rstp)## show rstp config
```

```
RSTP CONFIGURATION
------------------
Rapid STP/STP Enabled(Global)   : YES
RSTP/STP Enabled Ports          : 9,10,11,12,13,14,15,16
Protocol                        : Normal RSTP
Bridge ID                       : 00:00:00:20:06:25:ed:89
Bridge Priority                 : 0
Bridge Forward Delay            : 15
Bridge Hello Time               : 02
Bridge Max Age                  : 20
Root Port                       : 0
Root Path Cost                  : 0
Designated Root                 : 00:00:00:20:06:25:ed:89
Designated Root Priority        : 0
Root Bridge Forward Delay       : 15
Root Bridge Hello Time          : 02
Root Bridge Max Age             : 20
Topology Change count           : 0
Time Since topology Chg         : 12
```

FIGURE 87 – *Enabling RSTP and reviewing the RSTP variables*

The variables listed by the "**show rstp config**" command are:

Rapid Spanning Tree Enabled (Global): indicates whether STP is enabled or disabled globally i.e. if the values is YES, all ports have STP enabled, otherwise, all ports have STP disabled

Rapid Spanning Tree Enabled Ports: indicates which ports have RSTP enabled

Protocol: indicates type of RSTP protocol active

Bridge Priority: specifies the switch (bridge) priority value. This value is used along with the switch MAC address to determine which switch in the network is the root device. Lower values mean higher priority. Value ranges from 0 to 65535. Default value is 0

Bridge Forward Delay: indicates the time duration the switch will wait from listening to learning states and from learning to forwarding states. The value ranges from 4 to 30 seconds. Default value is 15

Bridge Hello Time: when the switch is the root device, this is the time between messages being transmitted. The value is from 1 to 10 seconds. Default value is 2 seconds

Bridge Max Age: this is the maximum time a message with STP information is allowed by the switch before the switch discards the information and updates the address table again. Value ranges from 6 to 160 seconds with default value of 20 seconds.

Root Port: indicates the port number, which is elected as the root port of the switch. A root port of "0" indicates STP is disabled

Root Path Cost: a path cost is assigned to individual ports for the switch to determine which ports are the forwarding points. A higher cost means more loops; a lower cost means fewer loops. More loops equal more traffic and a tree which takes a long time to converge – resulting in a slower system

Designated Root: shows the MAC address of the bridge in the network elected or designated as the root bridge.

Designated Root Priority: shows the designated root bridge's priority. Default value is 0

Root Bridge Forward Delay: indicates the designated root bridge's forward delay. This is the time the switch waits before it switches from the listening to the forwarding state. The default is 15 seconds. This value can be set between 4-30 seconds

Root Bridge Hello Time: indicates the designated root bridge's hello time. Hello information is sent out every 2 seconds

Root Bridge Max Age: indicates the designated root bridge's maximum age – after which it discards the information as being old and receives new updates

Topology Change count: since the last reboot, the number of times the topology has changed. Use this in conjunction with "show uptime" to find the frequency of the topology changes

Time Since topology Change: number of seconds since the last topology change

```
Magnum6K25(rstp)## show rstp ports

RSTP Port Configuration

-------------------------------------------------------------------------------------------------------------
Port#  Type      Priority Path Cost     State       Des. Bridge                Des. Port
-------------------------------------------------------------------------------------------------------------
09     TP(10/100)  128   2000000    Forwarding   00:00:00:20:06:25:ed:89    00:09
10     TP(10/100)  128   2000000    Disabled                                00:0a
11     TP(10/100)  128   2000000    Disabled                                00:0b
12     TP(10/100)  128   2000000    Disabled                                00:0c
13     TP(10/100)  128   200000     Forwarding   00:00:00:20:06:25:ed:89    00:0d
14     TP(10/100)  128   2000000    Disabled                                00:0e
15     TP(10/100)  128   2000000    Disabled                                00:0f
16     TP(10/100)  128   2000000    Disabled                                00:10

Magnum6K25(rstp)##
```

FIGURE 88 – *Reviewing the RSTP port parameters*

The variables listed by the "**show stp config**" command are:

Port#: indicates the port number. Value ranges from 01 to max number of ports in the switch

Type: indicates the type of port – TP indicates Twisted Pair

Priority: STP uses this to determine which ports are used for forwarding. Lower the number means higher priority. Value ranges from 0 to 255. Default is 128

Path Cost: This is the assigned port cost value used for the switch to determine the forwarding points. Values range from 1 to 2000000. Lower the value, lower the cost and hence the preferred route. The costs for different Ethernet speeds are shown below. The Path cost in STP is compared to the path cost in RSTP.

Port Type	STP Path cost	RSTP Path cost
10 Mbps	100	2,000,000
100 Mbps	19	200,000
1 Gbps	4	20,000
10 Gbps	2	2,000

Figure 89 – *Path cost as defined in IEEE 802.1d (STP) and 802.1w (RSTP)*

State: indicates the STP state of individual ports. Values can be Listening, Learning, Forwarding, Blocking and Disabled.

Des. Bridge: this is the port's designated root bridge

Des. Port: this is the port's designated root port

Another screen capture of the same command, from a larger network with several switches is shown below.

```
Magnum6K25# show rstp ports

RSTP Port Configuration

--------------------------------------------------------------------------------------------------------------
Port#    Type        Priority  Path Cost   State          Des. Bridge                  Des. Port
--------------------------------------------------------------------------------------------------------------
01       TP(10/100)  128       2000000     Disabled                                    00:01
02       TP(10/100)  128       2000000     Disabled                                    00:02
03       TP(10/100)  128       2000000     Disabled                                    00:03
04       TP(10/100)  128       2000000     Disabled                                    00:04
05       TP(10/100)  128       2000000     Disabled                                    00:05
```

```
06      TP(10/100)  128  200000   Forwarding  80:00:00:20:06:30:00:01  00:06
07      TP(10/100)  128  200000   Discarding  80:00:00:20:06:2b:0f:e1  00:07
08      TP(10/100)  128  2000000  Disabled                             00:08
09      Gigabit     128  20000    Forwarding  80:00:00:20:06:2b:0f:e1  00:09
10      Gigabit     128  20000    Forwarding  80:00:00:20:06:30:00:01  00:0a
Magnum6K25#
```

FIGURE 90 – *RSTP information from a network with multiple switches. Note the "show stp ports" command can be executed from the manager level prompt or from rstp configuration state as shown in the screen captures earlier.*

In this example, ports 9,10 have a path cost of 20,000 and are the least cost paths. These ports are connected to other switches and the ports are enabled as forwarding ports. Ports 6, 7 are also connected to other switches. From the state column, it indicates that port 7 is in a standby state as that port is discarding all traffic.

More CLI commands associated with RSTP in the RSTP configuration mode are:

Syntax **forceversion <stp|rstp>** - *set the STP or RSTP compatibility mode*

Syntax **show-forceversion** - *the current force version*

Syntax **show-timers** – *show the values of the timers set for RSTP*

Syntax **priority [port=<number|list|range>] value=<0-255 | 0-65535> -** *specifies the port or switch level priority. When a port(s) are specified the priority is associated with ports and their value is 0-255. If no ports are specified, then the switch (bridge) priority is specified and its value is 0-65535*

Syntax **cost port=<number|list|range> value=<0-65535>** - *cost is specific to a port and the port(s) have to be specified*

Syntax **port port=<number|list|range> status=<enable|disable>** - *specific ports may not need to participate in STP process. These ports typically would be end-stations. If you are not sure – let MNS-6K software make the decisions*

Syntax **timers forward-delay=<4-30> hello=<1-10> age=<6-160>** - *change the STP Forward delay, Hello timer and Aging timer values*

Priority: specifies the switch (bridge) priority value. This value is used along with the switch MAC address to determine which switch in the network is the root device. Lower values mean higher priority. Value ranges from 0 to 65535. Default value is 32768

Cost: A path cost is assigned to individual ports for the switch to determine which ports are the forwarding points. A higher cost means the link is "more expensive" to use and falls in the passive mode compared to the link with a lower cost. Value ranges from 0 to 65535. Default value is 32768

Status: Enables or disables a port from participating in STP discovery. It's best to only allow trunk ports to participate in STP. End stations need not participate in STP process.

Forward-Delay: indicates the time duration the switch will wait from listening to learning states and from learning to forwarding states. The value ranges from 4 to 30 seconds. Default value is 15

Hello: When the switch is the root device, this is the time between messages being transmitted. The value is from 1 to 10 seconds. Default value is 2 seconds

Age: This is the maximum time a message with STP information is allowed by the switch before the switch discards the information and updates the address table again. Value ranges from 6 to 160 seconds with default value of 20 seconds. Use a larger number when there are a large number of nodes. Maximum number of nodes are 160.

```
Magnum6K25# rstp

Magnum6K25(rstp)## show rstp

 RSTP CONFIGURATION
 ------------------
 Rapid STP/STP Enabled(Global) : NO

Magnum6K25(rstp)## show active-stp

 Current Active Mode: RSTP.
 RSTP is Disabled.

Magnum6K25(rstp)## rstp enable

Successfully set the RSTP status

Magnum6K25(rstp)## show active-stp

 Current Active Mode: RSTP.
 RSTP is Enabled.

Magnum6K25(rstp)## show rstp config

 RSTP CONFIGURATION
 ------------------
 Rapid STP/STP Enabled(Global)      : YES
 RSTP/STP Enabled Ports             : 9,10,11,12,13,14,15,16
 Protocol                           : Normal RSTP
 Bridge ID                          : 00:00:00:20:06:25:ed:89
 Bridge Priority                    : 0
 Bridge Forward Delay               : 15
 Bridge Hello Time                  : 02
 Bridge Max Age                     : 20
```

Check status of STP or RSTP. This command shows STP or RSTP is disabled.

```
Root Port                       : 0
Root Path Cost                  : 0
Designated Root                 : 00:00:00:20:06:25:ed:89
Designated Root Priority        : 0
Root Bridge Forward Delay       : 15
Root Bridge Hello Time          : 02
Root Bridge Max Age             : 20
Topology Change count           : 0
Time Since topology Chg         : 33

Magnum6K25(rstp)## show rstp ports

RSTP Port Configuration
-------------------------------------------------------------------------------------------------------------
Port#    Type        Priority  Path Cost   State       Des. Bridge                 Des. Port
-------------------------------------------------------------------------------------------------------------
09       TP(10/100)  128   2000000     Forwarding  00:00:00:20:06:25:ed:89     00:09
10       TP(10/100)  128   2000000     Disabled                                00:0a
11       TP(10/100)  128   2000000     Disabled                                00:0b
12       TP(10/100)  128   2000000     Disabled                                00:0c
13       TP(10/100)  128   200000      Forwarding  00:00:00:20:06:25:ed:89     00:0d
14       TP(10/100)  128   2000000     Disabled                                00:0e
15       TP(10/100)  128   2000000     Disabled                                00:0f
16       TP(10/100)  128   2000000     Disabled                                00:10

Magnum6K25(rstp)## forceversion rstp

Error: Force Version already set to Normal RSTP

Magnum6K25(rstp)## forceversion stp

Magnum6K25(rstp)## show-forceversion

 Force Version : Force to STP only

Magnum6K25(rstp)## show rstp config

 RSTP CONFIGURATION
 -----------------
 Rapid STP/STP Enabled(Global)  : YES
 RSTP/STP Enabled Ports         : 9,10,11,12,13,14,15,16
 Protocol                       : Force to STP only
 Bridge ID                      : 00:00:00:20:06:25:ed:89
 Bridge Priority                : 0
 Bridge Forward Delay           : 15
 Bridge Hello Time              : 02
 Bridge Max Age                 : 20
 Root Port                      : 0
 Root Path Cost                 : 0
 Designated Root                : 00:00:00:20:06:25:ed:89
 Designated Root Priority       : 0
 Root Bridge Forward Delay      : 15
 Root Bridge Hello Time         : 02
```

"forceversion" can be used for compatibility with STP devices. In this example, the switch is forced to STP mode.

```
Root Bridge Max Age              : 20
Topology Change count            : 0
Time Since topology Chg          : 100

Magnum6K25(rstp)## forceversion rstp

Magnum6K25(rstp)## show-forceversion

Force Version : Normal RSTP

Magnum6K25(rstp)## show rstp config

 RSTP CONFIGURATION
 ------------------
 Rapid STP/STP Enabled(Global)   : YES
 RSTP/STP Enabled Ports          : 9,10,11,12,13,14,15,16
 Protocol                        : Normal RSTP
 Bridge ID                       : 00:00:00:20:06:25:ed:89
 Bridge Priority                 : 0
 Bridge Forward Delay            : 15
 Bridge Hello Time               : 02
 Bridge Max Age                  : 20
 Root Port                       : 0
 Root Path Cost                  : 0
 Designated Root                 : 00:00:00:20:06:25:ed:89
 Designated Root Priority        : 0
 Root Bridge Forward Delay       : 15
 Root Bridge Hello Time          : 02
 Root Bridge Max Age             : 20
 Topology Change count           : 0
 Time Since topology Chg         : 141

Magnum6K25(rstp)## show-timers

 Forward Delay Timer    : 15 sec
 Hello Timer            : 2 sec
 Max Age                : 20 sec

Magnum6K25(rstp)## show rstp ports

RSTP Port Configuration

-------------------------------------------------------------------------------------------------------------
Port#     Type       Priority  Path Cost   State          Des. Bridge                Des. Port
-------------------------------------------------------------------------------------------------------------
09        TP(10/100)  128   2000000      Forwarding  00:00:00:20:06:25:ed:89   00:09
10        TP(10/100)  128   2000000      Disabled                              00:0a
11        TP(10/100)  128   2000000      Disabled                              00:0b
12        TP(10/100)  128   2000000      Disabled                              00:0c
13        TP(10/100)  128   200000       Forwarding  00:00:00:20:06:25:ed:89   00:0d
14        TP(10/100)  128   2000000      Disabled                              00:0e
15        TP(10/100)  128   2000000      Disabled                              00:0f
16        TP(10/100)  128   2000000      Disabled                              00:10
```

Using forceversion the switch is now operating using RSTP. Note the "show stp config" command also indicates the switch protocol is RSTP.

Magnum6K25(rstp)## priority port=13 value=100

Magnum6K25(rstp)## show rstp ports

RSTP Port Configuration

Port#	Type	Priority	Path Cost	State	Des. Bridge	Des. Port
09	TP(10/100)	128	2000000	Forwarding	00:00:00:20:06:25:ed:89	00:09
10	TP(10/100)	128	2000000	Disabled		00:0a
11	TP(10/100)	128	2000000	Disabled		00:0b
12	TP(10/100)	128	2000000	Disabled		00:0c
13	TP(10/100)	100	200000	Forwarding	00:00:00:20:06:25:ed:89	00:0d
14	TP(10/100)	128	2000000	Disabled		00:0e
15	TP(10/100)	128	2000000	Disabled		00:0f
16	TP(10/100)	128	2000000	Disabled		00:10

Magnum6K25(rstp)## cost port=13 value=250000

Magnum6K25(rstp)## show rstp ports

RSTP Port Configuration

Port#	Type	Priority	Path Cost	State	Des. Bridge	Des. Port
09	TP(10/100)	128	2000000	Forwarding	00:00:00:20:06:25:ed:89	00:09
10	TP(10/100)	128	2000000	Disabled		00:0a
11	TP(10/100)	128	2000000	Disabled		00:0b
12	TP(10/100)	128	2000000	Disabled		00:0c
13	TP(10/100)	100	250000	Forwarding	00:00:00:20:06:25:ed:89	00:0d
14	TP(10/100)	128	2000000	Disabled		00:0e
15	TP(10/100)	128	2000000	Disabled		00:0f
16	TP(10/100)	128	2000000	Disabled		00:10

Magnum6K25(rstp)## port port=9 status=disable

Magnum6K25(rstp)## show rstp ports

RSTP Port Configuration

Port#	Type	Priority	Path Cost	State	Des. Bridge	Des. Port
09	TP(10/100)	128	2000000	NO STP		00:09
10	TP(10/100)	128	2000000	Disabled		00:0a
11	TP(10/100)	128	2000000	Disabled		00:0b
12	TP(10/100)	128	2000000	Disabled		00:0c
13	TP(10/100)	100	250000	Forwarding	00:00:00:20:06:25:ed:89	00:0d
14	TP(10/100)	128	2000000	Disabled		00:0e
15	TP(10/100)	128	2000000	Disabled		00:0f

```
16      TP(10/100)  128  2000000    Disabled                                  00:10

Magnum6K25(rstp)## port port=9 status=enable

Magnum6K25(rstp)## show rstp ports

RSTP Port Configuration

-------------------------------------------------------------------------------------------------------------
Port#     Type      Priority  Path Cost   State          Des. Bridge                Des. Port
-------------------------------------------------------------------------------------------------------------
09      TP(10/100)  128  2000000    Forwarding  00:00:00:20:06:25:ed:89   00:09
10      TP(10/100)  128  2000000    Disabled                              00:0a
11      TP(10/100)  128  2000000    Disabled                              00:0b
12      TP(10/100)  128  2000000    Disabled                              00:0c
13      TP(10/100)  100  250000     Forwarding  00:00:00:20:06:25:ed:89   00:0d
14      TP(10/100)  128  2000000    Disabled                              00:0e
15      TP(10/100)  128  2000000    Disabled                              00:0f
16      TP(10/100)  128  2000000    Disabled                              00:10

Magnum6K25(rstp)## timers forward-delay=20 hello=5 age=30

Successfully set the bridge time parameters

Magnum6K25(rstp)## show rstp config

  RSTP CONFIGURATION
  ------------------
  Rapid STP/STP Enabled(Global)     : YES
  RSTP/STP Enabled Ports            : 9,10,11,12,13,14,15,16
  Protocol                          : Normal RSTP
  Bridge ID                         : 00:00:00:20:06:25:ed:89
  Bridge Priority                   : 0
  Bridge Forward Delay              : 20
  Bridge Hello Time                 : 05
  Bridge Max Age                    : 30
  Root Port                         : 0
  Root Path Cost                    : 0
  Designated Root                   : 00:00:00:20:06:25:ed:89
  Designated Root Priority          : 0
  Root Bridge Forward Delay         : 20
  Root Bridge Hello Time            : 05
  Root Bridge Max Age               : 30
  Topology Change count             : 0
  Time Since topology Chg           : 567

Magnum6K25(rstp)## exit

Magnum6K25#
```

FIGURE 91 – *Configuring RSTP on MNS-6K*

List of commands in this chapter

Syntax **set stp type=<stp|rstp> -** *Set the switch to support RSTP or change it back to STP. Need to save and reboot the switch after this command*

Syntax **rstp** – *enter the RSTP configuration mode*

Syntax **rstp <enable|disable>** *- enable RSTP – by default, this is disabled and has to be manually activated*

Syntax **port port=<number|list|range> [status=<enable|disable>] [migration=<enable>] [edge=<enable|disable>] [p2p=<on|off|auto>]** *- set the port type for RSTP*

Example **port port=<number|list|range> p2p= off** *- Set the "point-to-point" value to off on all ports that are connected to* ***shared LAN segments*** *(i.e. connections to hubs). The default value is auto. P2P ports would typically be end stations or computers on the network*

Example **port port=<number|list|range> edge=enable** – *enable all ports connected to other hubs, bridges and switches as edge ports*

Example **port port=<number|list|range> migration=enable** – *set this for all ports connected to other devices such as hubs, bridges and switches known to support IEEE 802.1d STP services, but cannot support RSTP services*

Syntax **show active-stp** – *status whether STP or RSTP is running*

Syntax **show rstp <config|ports>** *- display the RSTP or STP parameters*

Syntax **forceversion <stp|rstp>** *- set the STP or RSTP compatibility mode*

Syntax **show-forceversion** *- the current force version*

Syntax **show-timers** *- show the values of the timers set for RSTP*

Syntax **priority [port=<number|list|range>] value=<0-255 | 0-65535>** *- specifies the port or switch level priority. When a port(s) are specified the priority is associated with ports and their value is 0-255. If no ports are specified, then the switch (bridge) priority is specified and its value is 0-65535*

Syntax **cost port=<number|list|range> value=<0-65535>** *- cost is specific to a port and the port(s) have to be specified*

Syntax **port port=<number|list|range> status=<enable|disable>** *- specific ports may not need to participate in STP process. These ports typically would be end-stations. If you are not sure – let MNS-6K software make the decisions*

Syntax **timers forward-delay=<4-30> hello=<1-10> age=<6-160>** *- change the STP Forward delay, Hello timer and Aging timer values*

Chapter

14

14 – S-Ring™ and Link-Loss-Learn™ (LLL)

Speed up recovery from faults in Ethernet networks

S-Ring uses ring topology to provide fast recovery from faults. These are based on industry standard STP technologies. These technologies have been adapted to ring recovery applications by GarrettCom Inc. and these rings are called S-Ring. In addition, LLL enables a switch to rapidly re-learn MAC addresses in order to participate in S-Ring configurations. One advantage of S-Ring is that the fast recovery works with managed as well as some non managed switches as well.

In the last two chapters we looked at how RSTP or STP can be used to bring resiliency to a meshed network. This chapter's focus is to look at ring topologies and how these topologies can be used to provide faster recovery times than what STP or RSTP can offer. Both RSTP and STP are industry standard protocols and can be used with networking switches from different vendors.

LLL triggers action on the device supporting LLL when a connection is broken or there is loss of the link signal on a ring port. LLL can be used with S-Ring on managed switches such as the GarrettCom Magnum 6K family of switches. LLL can also be used on managed switches such as Magnum 6K family of switches, Magnum mP62 as well as on unmanaged switches such as ESD42 switches. Note that LLL can also be used with non-ring topologies (such as mesh topologies) using RSTP or STP where it does the necessary actions for fault recovery (such as re-learn addresses) in case of a link failure.

S-Ring is a ring technology using the GarrettCom MNS-6K software. In a S-Ring, a switch is designated as a "Ring Manager". Devices in a S-Ring can be managed switches such as the Magnum 6K family of switches, other managed switches such as Magnum mP62 or unmanaged switches such as ESD42 or even hubs which leverages LLL. S-Ring is a licensed product from GarrettCom Inc. GarrettCom Inc. also licenses this technology to other companies who are interested in implementing the resiliency capabilities offered by S-Ring.

S-Ring and LLL concepts

S-Ring is built upon networking software standards such as IEEE 802.1d Spanning Tree Protocol (STP) or Rapid Spanning Tree Protocol (RSTP) based on IEEE 802.1w. The purpose of S-Ring is to define two ports which participate in the RSTP/STP tree structure in a ring topology as opposed to a meshed topology. S-Ring running on the ring manager switch leverages this capability to recover quickly from fault situations. The recovery times for S-Ring based networks are within a few hundred milliseconds. Recovery time for STP devices is in tens of seconds (typically 30-50 seconds in most networks) or sub second to a few seconds for RSTP networks. The biggest advantage of S-Ring, besides the fast recovery time, is the defined ring topology which makes the network manageable. S-Ring can also be an overall lower cost solution as there are hubs as well as switches which can be used in the ring.

In the Magnum 6K family of switches as well as in other unmanaged switches such as the ESD42, a feature called Link-Loss-Learn™ (LLL) can be activated to immediately flush its address buffer and relearn the MAC addresses that route packets around the fault. This procedure, which is similar to switch initialization, occurs within milliseconds, resulting in fast ring recovery. An S-Ring implementation watches for link-loss as well as for STP/RSTP BPDU packet failures and responds to whichever occurs first. In most instances the link-loss will be detected faster than the two-second interval at which the BPDU packets are successfully passed around the ring. Typical ring recovery times using S-Ring software and mP62 edge switches with the LLL feature enabled on the ring ports is less than 250 milliseconds, even with 50 or more Magnum 6K family of switches in a ring structure. Without LLL activation, the Magnum 6K family of switches address buffer aging time (5 minutes default) could be the gating factor in ring recovery time. LLL is used on S-Ring and helps speed up the ring recovery time.

S-Ring operates from specifically defined port pairs that participate in a ring-topology. Multiple rings of different pairs on the same switch are also supported; however, intersecting rings or a "ring of rings" or "overlapping rings" is not supported in the current version. While S-Ring builds upon the foundation of RSTP or STP, S-Ring offers an additional topology option to network architects. The two ends of a ring must be connected to two ports in a Magnum 6K Switch that is enabled with the S-Ring software. The end points of the ring provide an alternate path to reach the switch that has failed. The in-out pairs of the ports to other devices in the ring have to be enabled with LLL. Some items to be aware of with S-Ring are as follows:

1. The S-Ring feature is a separately licensed module for the MNS-6K software package. This module must be enabled by means of a software key
2. Only one switch is the "Ring Master". That switch has S-Ring Software authorized (enabled) for that device. Thus only one license key is needed per ring (and not per switch)

3. There can be multiple S-Rings on a given Magnum 6K switch. There can be multiple ring topologies in a network. Each ring has to be a separate ring. Ring of rings or overlapping rings are not supported at this time
4. S-Ring topologies support one failure in the network. A second failure may create isolated network islands
5. At least one untagged VLAN must be available for the BPDU's to propagate through the network to update RSTP/STP status
6. S-Ring faults can be software signaled to alarm contacts.

Comparing resiliency methods

So far we have briefly covered S-Ring with LLL, RSPT as well as STP. The table below summarizes some decision criteria on selecting RSPT vs STP vs S-Ring (and LLL.)

	S-Ring with LLL	RSTP	STP
License	A license key is needed. One key per ring manager switch	Included in MNS-6K	Included in MNS-6K
Spanning Tree	Works with RSTP or STP devices	--	--
Devices supported	Managed or certain non managed Magnum switches. Requires at least one Magnum 6K switch as ring manager	Many	Many
Recovery decision	Centralized to "Ring Manager". LLL provides triggers to recomputed topology for ring members. Also works with RSTP or STP.	Typically done using BPDU. Can take time.	Typically done using BPDU. Can take time.
Topology	Single ring, multiple rings, no overlapping rings or ring of rings	Mesh topology – can have multiple paths	Mesh topology – can have multiple paths
Interoperability	Works with managed 6K family of switches, other managed switches such as mP62 and non managed switches as well as some hubs	Wide range of products, including other vendor products	Wider range of products, including other vendor products
Recovery time	Fast	Medium – sub second to a few seconds	Slow – in tens of seconds

	S-Ring with LLL	RSTP	STP
Resiliency	Fast recovery from a single point of failure. Ring Master is responsible for decision making	Multiple points of failure – each connected node can be in stand-by	Multiple points of failure – each connected node can be in stand-by
Software Cost	Licensed per ring	Included in MNS-6K	Included in MNS-6K
Hardware cost	One Managed 6K per ring. Multiple choices for members of the ring	Many choices available, making it cost effective	Many choices available, making it cost effective
Software Alarm	Yes	No	No
Ring Size	50+ nodes	NA	NA
Dual-Homing	Supports dual-homing to members in the ring	Supports dual-homed device to devices in the network	Supports dual-homed device to devices in the network

RSTP/STP Operation without S-Ring

S-Ring supports non managed switches as long as LLL capability is supported on that switch. A ring is a special form of mesh network topology. The two top-of-the-ring ports form an otherwise-illegal redundant path, and standard RSTP/STP causes one of these two ports to block incoming packets in order to enable normal Ethernet traffic flow. All ring traffic goes through the non-blocking port for normal LAN operation. This port is designated Forwarding Port. Meanwhile, there is a regular flow of status-checking multi-cast packets (called BPDUs or Bridge Protocol Data Units) sent out by RSTP/STP that move around the ring to show that things are functioning normally.

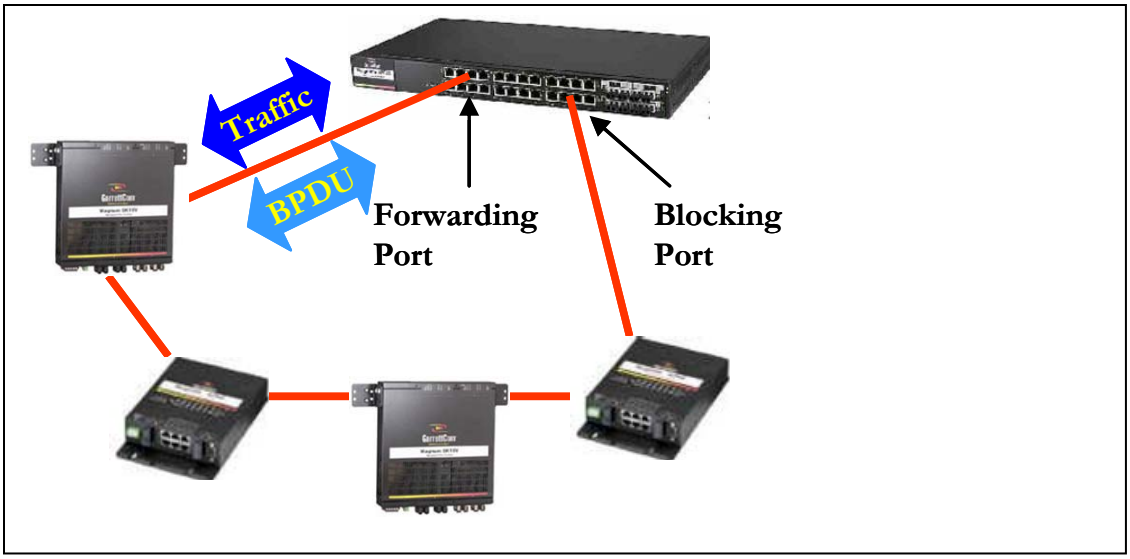


FIGURE 92 – *Normal RSTP/STP operations in a series of switches. Note – this normal status is designated RING_CLOSED*

This normal status is designated as RING_CLOSED. Operations will continue this way indefinitely until a fault occurs.

A fault anywhere in the ring will interrupt the flow of standard RSTP/STP status-checking BPDU packets, and will signal to RSTP/STP that a fault has occurred. According to the standard RSTP/STP defined sequence, protocol packets are then sent out, gathered up and analyzed to enable RSTP/STP to calculate how to re-configure the LAN to recover from the fault. After the standard RSTP/STP reconfiguration time period (typically 20 to 30 seconds), the RSTP/STP analysis concludes that recovery is achieved by changing the blocking port of the ring port-pair to the forwarding state.

Intentionally left blank

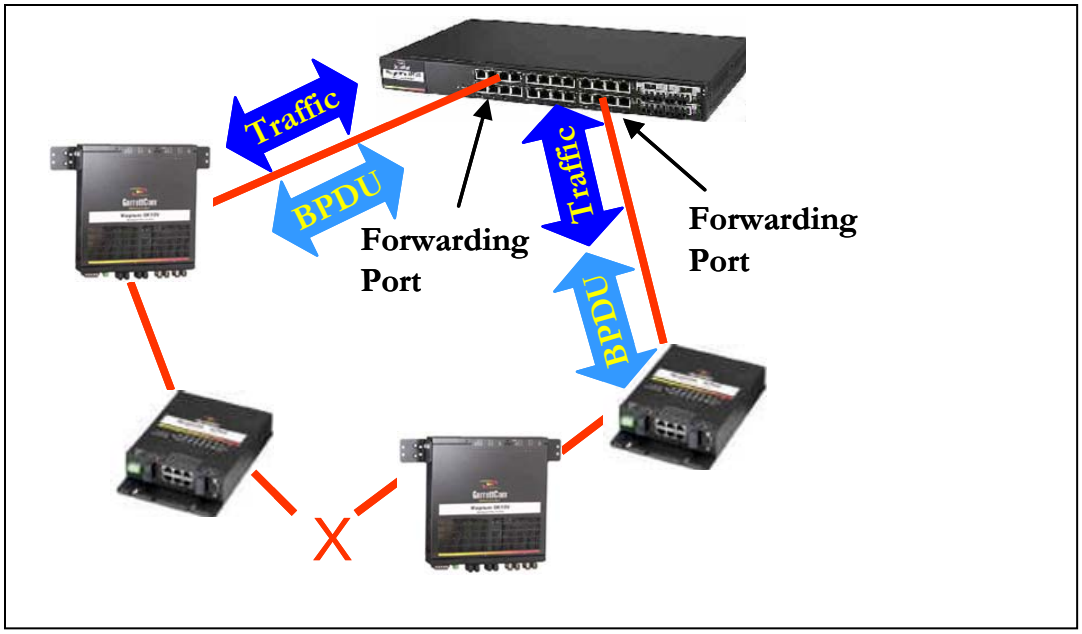


FIGURE 93 – *A fault in the ring interrupts traffic. The blocking port now becomes forwarding so that traffic can reach all switches in the network. Note – the mP62 as well as the ESD42 switches support LLL and can participate in S-Ring as an access switch*

When this change is made by RSTP/STP and both of the ring manager switch's ring ports are forwarding, the fault is effectively bypassed and there is a path for all LAN traffic to be handled properly. This abnormal status is designated RING_OPEN, and may continue indefinitely, until the ring fault is repaired. At that time, RSTP/STP will change one of the ring control ports to be a blocking port again. This recovery operation may take thirty seconds to a few minutes, depending on the number of switches and other RSTP/STP parameters in operation.

RSTP/STP Operation with S-Ring

When the Magnum 6K family of switches is used in the network and the S-Ring feature is enabled, the result of a ring-fault is the same but the recovery is faster. The S-Ring capability overrides the normal RSTP/STP analysis for the ring-pair ports of the ring manager (or ring-control) switch, providing quick recovery of the ring fault without conflicting with standard RSTP/STP.

The Magnum 6K family of switches, running MNS-6K software, offer users the choice of selecting S-Ring when RSTP or STP is configured and in use. For the S-Ring, the user must select two ports of one 6K switch to operate as a pair in support of each Ethernet ring, and attach to the two "ends" of each ring as it comes together at the ring control switch.

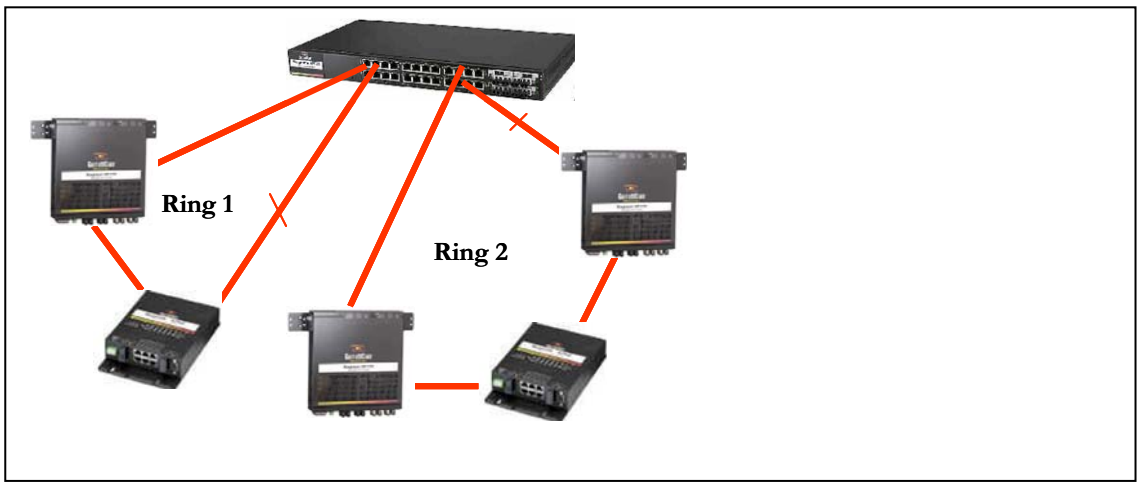


FIGURE 94 – *More than one S-Ring pair can be selected and more than one S-Ring can be defined per switch. Note – the mP62 as well as the ES42 switches support LLL and can participate in S-Ring as an access switch*

More than one S-Ring port-pair may be selected per ring control switch. Each port-pair will have its own separate attached ring, and each port-pair operates on faults independently. The port-pairs may be of any media type, and the media type does not have to be the same for the pair. With the Magnum 6K family of switches, a port operating at any speed (10Mb, 100Mb, 1 Gb) may be designated as part of an S-Ring port-pair ensuring proper Ethernet configuration of the ring elements.

After selecting a port-pair for a ring, the manager or administrator enables S-Ring (on the selected port-pairs via S-Ring software commands. One command (enable / disable) turns S-Ring on and off. Another command adds / deletes port- pairs. Other commands provide for status reporting on the ring. The MNS-6K software package provides for remote operation, access security, event logs, and other industry-standard managed network capabilities suitable for industrial applications requiring redundancy.

When S-Ring is enabled for a port-pair, fault detection and recovery are armed for the associated ring. The standard RSTP/STP functions are performed by the Magnum 6K family of switches for other ports in the same manner as they would be without S-Ring enabled, when operating in the RING_CLOSED state. During this state, S-Ring is also watching the flow of the BPDU packets that move around the ring between the designated part-pair.

The extra capability of S-Ring comes into play when a fault occurs. When the flow of BPDU packets around the ring is interrupted (or when Link-Loss is sensed on one of the ports of the ring port-pair by S-Ring), S-Ring quickly acts to change the blocking port's state to forwarding. No waiting for STP analysis. No waiting for RSTP analysis. No checking for other possible events. No other ports to look at. No 30-second delay before taking action. S-Ring takes immediate corrective action for quick recovery from the fault in the ring. The ring becomes two strings topologically, as shown above, and there is a path through the two strings for all normal LAN traffic to move as needed to maintain LAN operations.

When the fault is cured, the re-emergence of the ring structure enables the BPDU packets to flow again between the ring's port-pair. This is recognized by S-Ring (and RSTP/STP), and one of the ports in the ring's port pair is changed to the blocking state. S-Ring takes the recovery action immediately, not waiting for the 30-second STP analysis.

Rings are simple structures. Either one port of a pair is forwarding or both are. Not complicated; not much to go wrong.

A Link-loss on one of the Magnum 6K Switch's ring ports is an alternative trigger for S-Ring to initiate fault recovery. The Link-loss trigger almost always comes quicker after a fault (a few milliseconds) than the loss of a BPDU packet which is gated by the standard STP 2-second "hello time" interval. So the Link-loss trigger will almost always provide faster fault detection and faster recovery accordingly.

LLL with S-Ring

The Link-Loss-Learn™ feature, available on Magnum 6K family of switches can significantly reduce switch address memory decay time, resulting in more rapid reconfiguration. With Link-Loss-Learn (LLL), Magnum 6K family switches in a ring can flush their address memory buffer and quickly re-learn where to send packets, enabling them to participate in a very quick recovery or restoration. Note that a Link-loss on any Magnum 6K Switch port somewhere in the ring is an alternative trigger for S-Ring to act for either fault recovery or ring restoration. The interruption (or the restoration) of the flow of BPDU packets is one trigger, link-loss is another, and action is taken by S-Ring based on whichever occurs first. For the ports connected to the ring, it is important to enable LLL on these ports only for all switches in the ring - except the ring manager.

Ring learn features

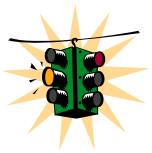
One of the S-Ring software commands, "**s-ring learn**", causes the scanning of all ports in the Magnum 6K family of switches for the presence of rings. This command can be a handy tool in setting up the S-Ring product for correct initial operation. During a ring-learn scan, if any port receives a BPDU packet that was also originated by the same switch, the source and destination ports are designated as a ring port-pair and they are automatically added to the S-Ring port-pair list for that 6K Switch. The user can enable or disable ports pairs that are on the S-Ring list by CLI commands in order to exercise final control if needed.

Configuring S-Ring

S-Ring is a licensed software feature from GarrettCom Inc. Before using the S-Ring capabilities; authorize the use of the software with the license key. To obtain the license key,

please contact GarrettCom Inc. Sales (for purchasing the S-Ring feature) or Technical Support (to obtain the 12 character key.) If the S-Ring capability was purchased along with the switch, the software license code will be included with the switch.

Syntax **authorize <module> key=<security key>** *- activate the S-Ring capabilities. Don't forget to use the "save" command to save the key*



In the example below – STP is used to show how S-Ring is setup. S-Ring will also work with RSTP.

```
Magnum6K25# authorize s-ring key=abc123456789
S-RING Module Successfully Authorized
Please Save Configuration.
Magnum6K25# save

 Saving current configuration
 Configuration saved

 Saving current event logs
 Event logs saved

Magnum6K25# reboot

  Proceed on rebooting the switch? [ 'Y' or 'N' ] Y

  Do you wish to save current configuration? [ 'Y' or 'N' ] Y
 Saving current configuration
 Configuration saved

  Rebooting now...
```

FIGURE 95 – *Activating S-Ring on the switch*

Since S-Ring uses RSTP/STP, STP has to be activated and enabled. Please refer to the Chapter on Spanning Tree Protocol (STP) for more information. Some of the commands are repeated here for clarity. Using S-Ring with multiple switches, it is recommended to do the following:

1) On the switch which is the root node, authorize the use of S-Ring software
2) On the switch which is the root node or where the top of the ring ports are configured, enable STP
3) On the root node enable S-Ring and add the necessary ports as S-Ring ports
4) On all other switches (except the root node), disable STP
5) On all other switches (except the root node), enable LLL

Ports associated with S-Ring should have the following settings

- Auto negotiation - disable
- Speed - Fixed
- Same Speed

- Same Duplex and
- LLL - enable

The necessary commands are

Syntax **stp** – *STP Configuration mode*

Syntax **stp <enable|disable>** - *Start (Enable) or stop (Disable) STP*

Syntax **set stp type=<stp|rstp>** - *set the spanning tree protocol to be IEEE 802.1d or 802.1w (Spanning Tree Protocol or Rapid Spanning Tree Protocol)*

Syntax **show active-stp** – *Display which version of STP is currently active*

Syntax **show s-ring** – *show the status of S-Ring status and configuration*

Syntax **s-ring <enable|disable>** - *enable or disable S-Ring capabilities*

Syntax **s-ring learn** – *start the learning process to discover the ring and the ports which make up the S-Ring*

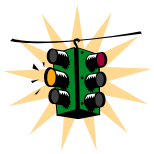
Syntax **s-ring add port=<port1,port2>** - *define ports which make up the S-Ring ports. Note as discussed earlier, you can create multiple S-Rings on a switch*

Syntax **s-ring del port=<port1,port2>** - *remove the switch from S-Ring topology by eliminating the end ports on the switch*

```
Magnum6K25(stp)## show s-ring

S-Ring Status:

    sRing Status: DISABLED

    Port 1  Port 2  Status

Magnum6K25(stp)## s-ring enable

S-RING Enabled.

Magnum6K25(stp)## show s-ring

S-Ring Status:

    sRing Status: ENABLED

    Port 1  Port 2  Status


Magnum6K25(stp)## s-ring add port=1,7
```

```
Ports 1 and 7 Configured for sRing Operation

Magnum6K25# show s-ring

Magnum Ring Status:

    sRing Status: ENABLED

    Port 1  Port 2  Status

    1       7       CLOSED
```

FIGURE 96 – *S-Ring configuration commands for root switch*



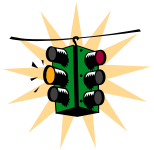
If the BPDU stream is broken, or it finds the *Link-Loss-Learn* signal, the system will immediately force STP to put both ports in forwarding mode. Should that happen, the ring status will be displayed as "OPEN"

If the ring sees BPDUs not belonging to itself on any of the ports, it will set the ring to "UNKNOWN" state, and stop all ring activity on that ring.

The ring activity has several timers and safeguards to prevent erroneous operation. Ring faults are not expected to happen in quick successions. If the ring system sees a sequence of changes in the duration of a less than a second each, it will temporarily ignore the signals and leave STP to reconfigure the ring (network) using the normal IEEE 802.1d algorithms.

With S-Ring it is also critical to setup and configure Link-Loss-Learn as the S-ring can recover from fault situations a lot faster. For configuring LLL, use the commands listed below. **LLL has to be setup on <u>other switches</u> in the ring for the in-out ports on the switch.**

Syntax **lll <enable|disable>** - *enable or disable LLL on the switch*



If STP is enabled, Link Loss Learn will not work even though it was enabled. LLL is not enabled on the root node.

Syntax **lll add port=<port|list|range>** - *enable LLL on the list of specified ports*

Syntax **lll del port=<port|list|range>** - *disable LLL on the list of specified ports*

Syntax **show lll** – *display the status of LLL*

```
Magnum6K25# stp

Magnum6K25(stp)## lll enable
```

```
Link-Loss-Learn Enabled.

Magnum6K25(stp)## lll add port=1,2,3
Added Ports: 1,2,3

Magnum6K25(stp)##show lll
Link-Loss-Learn Status:

LLL Status: ENABLED
LLL Enabled on Ports: 1,2,3

Magnum6K25(stp)## lll del port=2,3
Deleted Ports: 2,3

Magnum6K25(stp)## lll disable
Link-Loss-Learn Disabled.
```

FIGURE 97 – *Link Loss Learn (LLL) setup. Setup LLL on ports connected to other switches participating in S-Ring*

List of commands in this chapter

Syntax **authorize <module> key=<security key>** - *activate the S-Ring capabilities. Don't forget to use the "save" command to save the key*

Syntax **stp** – *STP Configuration mode*

Syntax **stp <enable|disable>** - *Start (Enable) or stop (Disable) STP*

Syntax **set stp type=<stp|rstp>** - *set the spanning tree protocol to be IEEE 802.1d or 802.1w (Spanning Tree Protocol or Rapid Spanning Tree Protocol)*

Syntax **show active-stp** – *Display which version of STP is currently active*

Syntax **show s-ring** – *show the status of S-Ring status and configuration*

Syntax **s-ring <enable|disable>** - *enable or disable S-Ring capabilities*

Syntax **s-ring learn** – *start the learning process to discover the ring and the ports which make up the S-Ring*

Syntax **s-ring add port=<port1,port2>** - *define ports which make up the S-ring ports. Note as discussed earlier, you can create multiple S-Rings on a switch*

Syntax **s-ring del port=<port1,port2>** - *remove the switch from S-Ring topology by eliminating the end ports on the switch*

Syntax **lll <enable|disable>** - *enable or disable LLL on the switch*

Syntax **lll add port=<port|list|range>** *- enable LLL on the list of specified ports*

Syntax **lll del port=<port|list|range>** *- disable LLL on the list of specified ports*

Syntax **show lll** – *display the status of LLL*

Syntax **rstp** – *STP Configuration mode*

Syntax **rstp <enable|disable>** *- Start (Enable) or stop (Disable) STP*

Syntax **set stp type=<stp|rstp>** *- set the spanning tree protocol to be IEEE 802.1d or 802.1w (Rapid Spanning Tree Protocol)*

Syntax **show active-stp** – *Display which version of STP is currently active*

Chapter 15

15 – Dual-Homing

Fault tolerance options for edge devices

Designing and implementing high-availability Ethernet LAN topologies in networks can be challenging. Traditionally, the choices for redundancy for edge of the network devices were too limited, too expensive, and too complicated to be considered in most networks. Redundancy at the edge of the network is greatly simplified by the using dual-homing.

.

Dual-Homing concepts

In Ethernet LANs, dual-homing is a network topology that adds reliability by allowing a device to be connected to the network by way of two independent connection points (points of attachment). One connection point is the operating connection, and the other is a standby or back-up connection that is activated in the event of a failure of the operating connection. A dual-homing switch (such as EDS42) offers two attachments into the network or two independent media paths and two upstream switch connections. In the case of the Magnum 6K family of switches, any two ports can be defined as dual-home ports to provide this level of redundancy. Loss of the Link signal on the operating port connected upstream indicates a fault in that path, and traffic is quickly moved to the standby connection to accomplish a fault recovery.

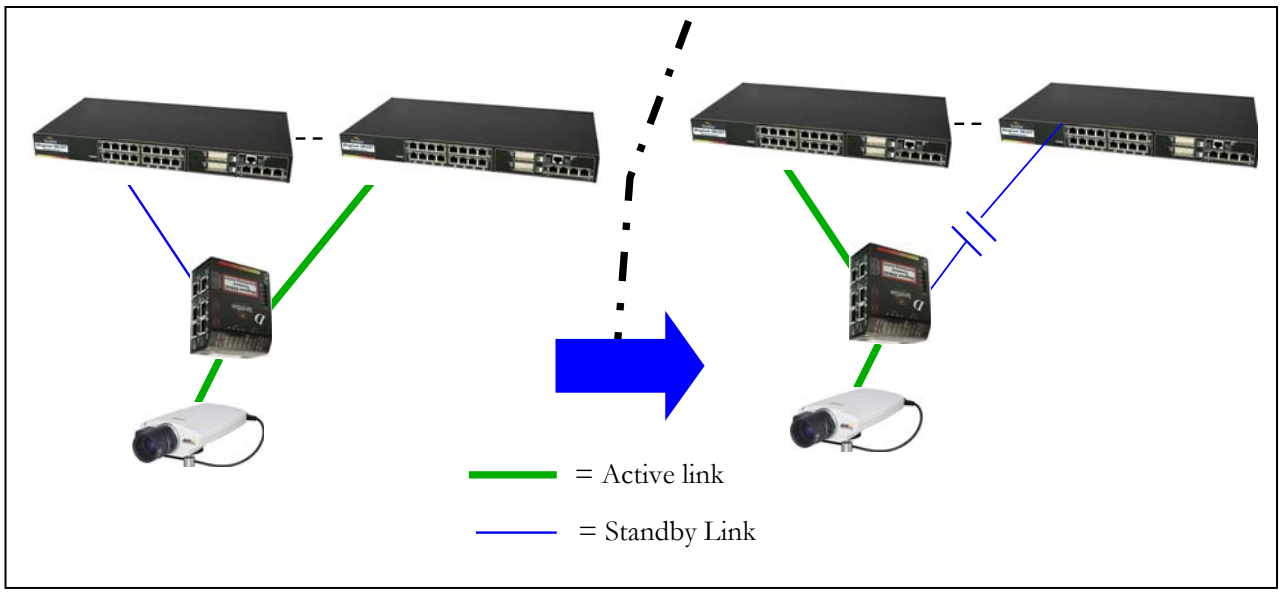


FIGURE 98 – *Dual-homing using ESD42 switch and Magnum 6K family of switches. In case of a connectivity break – the connection switches to the standby path or standby link*

In those situations where the end device is a PoE device (for example, a video surveillance camera, as shown above) a Magnum 6K switch with MNS-6K can provide PoE to the end devices as well as other advantages such as IGMP, managed configuration and more. To provide the managed reliability to the end devices, dual-homing can be used with MNS-6K devices.

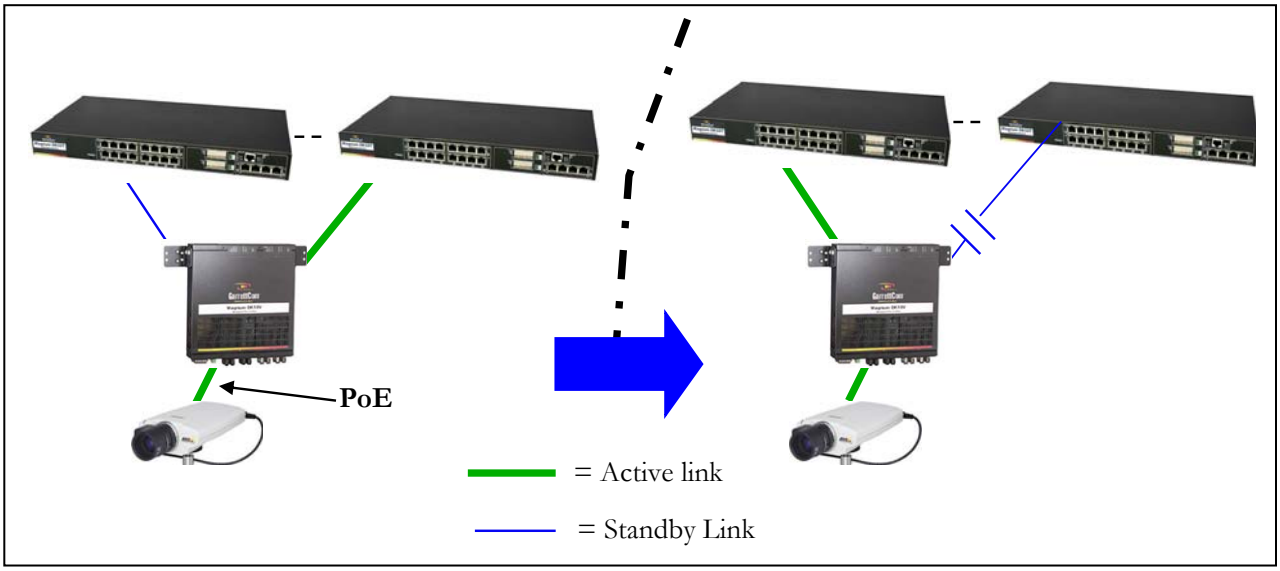


FIGURE 99 – *Dual-homing using Magnum 6K family of switches. Note the end device (video surveillance camera) can be powered using PoE options on Magnum 6K family of switches. In case of a connectivity break – the connection switches to the standby path or standby link*

Because it takes advantage of Ethernet standards, the dual-homing redundancy features of the ESD42 as well as those for MNS-6K work with any brands or models of Ethernet

switches upstream. With MNS-6K, the user has to define the set of ports which make up the dual-home ports.

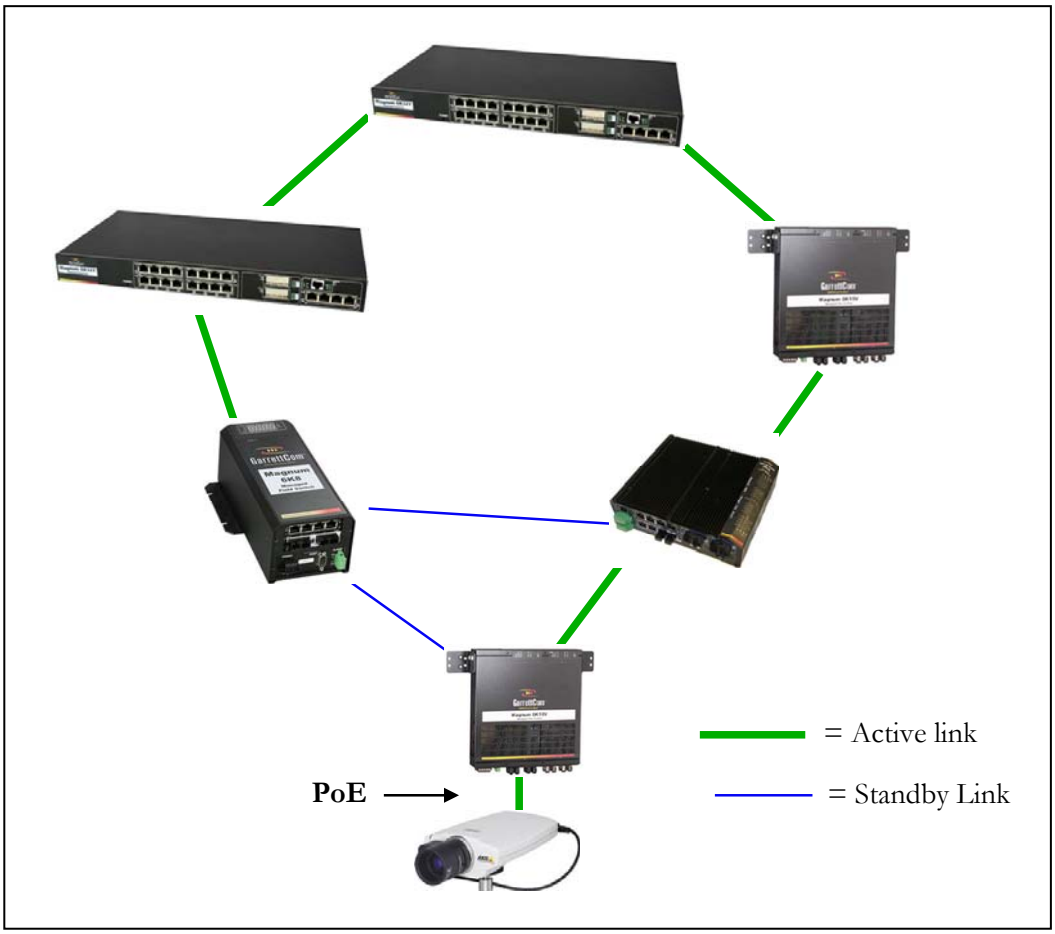
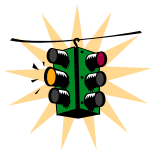


FIGURE 100 – *Using S-Ring and dual-homing, it is possible to build networks resilient not only to a single link failure but also for one device failing on the network*

The following points should be remembered for setting up dual-homing



- **Configure dual-homing before connecting the Ethernet connectors (cables) in the switch**[6]
- **Only one set of dual-homing ports can be defined per switch**
- Port types (Copper vs fiber) as well as speeds can be mixed and matched – both ports need not be identical
- By default dual-homing is turned off – you have to enable it after the ports are defined
- Dual-homing ports can span different modules in a switch

[6] If dual homing is not configured there is a potential a loop can be created and either STP or RSTP will setup the port in the active stand-by mode. Dual-homing may not work if one of the dual-homed port is in active standby. To avoid that situation, it is recommended to configure dual-homing first.

Dual-Homing Modes

There are two modes in which the dual-homing works. The first one is where the ports are "equivalent" i.e. if one port fails, the other one take over, however, if the first (failed) port recovers, the active port does not switch back.

The second mode of operation is primary-secondary mode. In this mode of operation, the primary port is explicitly defined and the secondary port is explicitly defined. In the primary-secondary mode of operation, if the primary fails, the secondary takes over. When the primary recovers, the secondary switches back from active state to passive state and the primary port is now the active port.

The primary-secondary mode has to be explicitly setup. The primary-secondary mode of operation is only possible on managed switches such as the Magnum 6K family of switches.

The primary-secondary mode of operation allows the network manager to determine on which path the packets will flow (as a default).

Configuring Dual-Homing

The following commands are used for configuring dual-homing

Syntax **dualhome** – *enter the dual-homing configuration sub-system*

Syntax **dualhome <enable|disable>** – *enable or disable dual-homing*

Syntax **dualhome add port1=<port#> port2=<port#>** – *dual-homing setup similar to that of unmanaged switches such as ESD42*

OR

Syntax **dualhome add primary=<port#> secondary=<port#>** – *dual-homing setup as primary-secondary mode*

Syntax **dualhome del** – *Delete the dual-homing setup*

Syntax **show dualhome** – *Display dual-homing status*

The following set of commands show how dual-homing is setup. In the example below both modes of dual-homing operation is setup.

```
Magnum6K25# dualhome ?
dualhome              : Configures Dual homing

Usage
dualhome <enter>

Magnum6K25# show dualhome
  Dual Homing Status        : DISABLED

Magnum6K25# dualhome

Magnum6K25(dualhome)## dualhome add port1=10 port2=11
  Dual Homing Ports configured

Magnum6K25(dualhome)## dualhome enable
  Dual Homing Enabled.

Magnum6K25(dualhome)## show dualhome

  Dual Homing Status        : ENABLED
  Dual Homing Ports         : 10 11
  Dual Homing Active On Port : 10

Magnum6K25(dualhome)## dualhome del
  Dual Homing Ports Deleted and Dual Homing Disabled.

Magnum6K25(dualhome)## show dualhome
  Dual Homing Status        : DISABLED

Magnum6K25(dualhome)## dualhome add primary=10 secondary=11
  Dual Homing Ports configured

Magnum6K25(dualhome)## show dualhome

  Dual Homing Status        : DISABLED
  Dual Homing Ports         : Primary: 10, Secondary: 11

Magnum6K25(dualhome)## dualhome enable
  Dual Homing Enabled.

Magnum6K25(dualhome)## show dualhome

  Dual Homing Status        : ENABLED
  Dual Homing Ports         : Primary: 10, Secondary: 11
  Dual Homing Active On Port : 10

Magnum6K25(dualhome)## exit

Magnum6K25#
```

FIGURE 101 – *configuring dual-homing*

List of commands in this chapter

Syntax **dualhome** – *enter the dual-homing configuration sub-system*

Syntax **dualhome <enable|disable>** – *enable or disable dual-homing*

Syntax **dualhome add port1=<port#> port2=<port#>** – *dual-homing setup similar to that of unmanaged switches such as ESD42*

OR

Syntax **dualhome add primary=<port#> secondary=<port#>** – *dual-homing setup as primary-secondary mode*

Syntax **dualhome del** – *Delete the dual-homing setup*

Syntax **show dualhome** – *Display dual-homing status*

Chapter 16

16 – Link Aggregation Control Protocol (LACP)

Increase Network throughput and reliability

Link aggregation Link Aggregation Control Protocol (LACP) is part of an IEEE specification (IEEE 802.3ad) that allows several physical ports to be grouped or bundled together to form a single logical channel. This increases the throughput across two devices and provides improved reliability.

LACP concepts

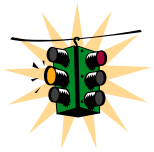
The IEEE802.3ad standard provides for the formation of a single Layer 2 link from two or more standard Ethernet links using the Link Aggregation Control Protocol (LACP). LACP provides a robust means of assuring that both ends of the link are up and agree to be members of the aggregation before the link member is activated. LACP trunking is a method of combining physical network links into a single logical link for increased bandwidth. With LACP the effective bandwidth of a trunk and network availability is increased. Two or more Fast Ethernet connections are combined as one logical trunk in order to increase the bandwidth and to create resilient and redundant links. By taking multiple LAN connections and treating them as a unified, aggregated link, Link Aggregation provides the following important benefits:

- Higher link availability – in case a link fails, the other links continue to operate
- Increased link capacity – the effective throughput is increased
- Better port utilization – allows unused ports to be used as trunk ports allowing better throughput and availability
- Interoperability – being a standard allows LACP to work across different hardware platforms where LACP is supported

Failure of any one physical link will not impact the logical link defined using LACP. The loss of a link within an aggregation reduces the available capacity, but the connection is maintained and the data flow is not interrupted.

The performance is improved because the capacity of an aggregated link is higher than each individual link alone. 10Mbps or 10/100Mbps or 100Mbps ports can be grouped together to form one logical link.

Instead of adding new hardware to increase speed on a trunk – one can now use LACP to incrementally increase the throughput in the network, preventing or deferring hardware upgrades. Some known issues with LACP on the Magnum 6K family of switches are:



- LACP will not work on Half Duplex ports.
- All trunk ports must be on the same module. Trunk ports cannot be spread out across different modules.
- All trunk ports MUST have the same speed setting. If the speed is different, LACP shows an error indicating speed mismatch.
- Many switches do not forward the LACPDUs by default. So, it is possible to hook up multiple ports to these switches and create an Ethernet loop. (In many cases this is prevented by Spanning Tree running on these switches).
- All ports in a trunk group should be members of the same VLAN. Each port can be a member of multiple VLANs, but each port should have at least one VLAN that is common to **both** the port groups.
- The LACPDU packets are sent out every 30 seconds. It is possible that in configuring LACP, a loop can be created until LACP notification is completed. It is recommended to configure LACP first and then physically connect the ports to avoid this potential issue.
- Port Security will not work with the ports configured for LACP.
- IGMP will work with the primary LACP port only. All IGMP traffic is sent via a primary port. If needed, this port can be mirrored for traffic analysis.

LACP Configuration

For LACP to work on the Magnum 6K family of switches, only one trunk per module can be created. Some valid connections are shown in the picture below.

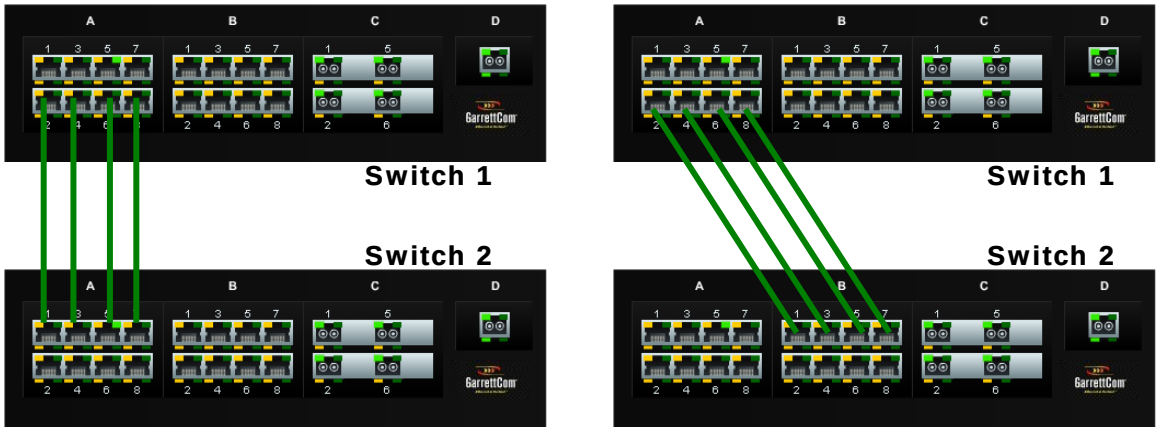


FIGURE 102 – *Some valid LACP configurations.*

Should trunks be created so as to span multiple ports, a "trunk mismatch" error message is printed on the console. An example of an incorrect configuration is shown below.

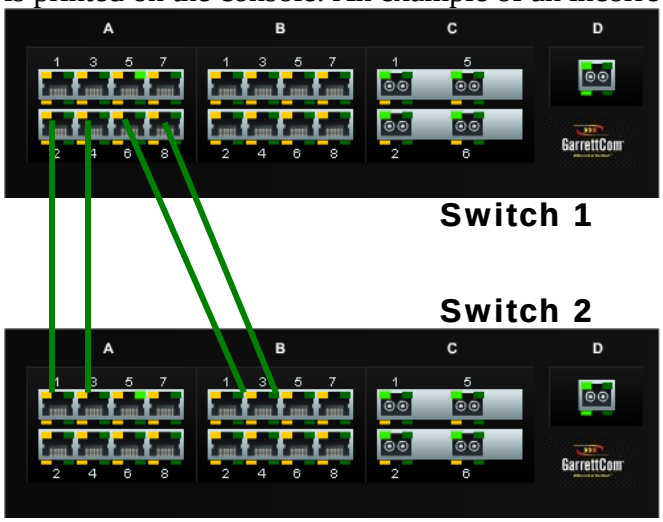


FIGURE 103 – *an incorrect LACP connection scheme for Magnum 6K family of switches. All LACP trunk ports must be on the same module and cannot span different modules.*

Another example is highlighted below where some ports belong to VLAN 10 (shown in red) and other ports belong to VLAN 20 (shown in blue). If the port groups do not have a common VLAN between them, LACP does not form a connection.

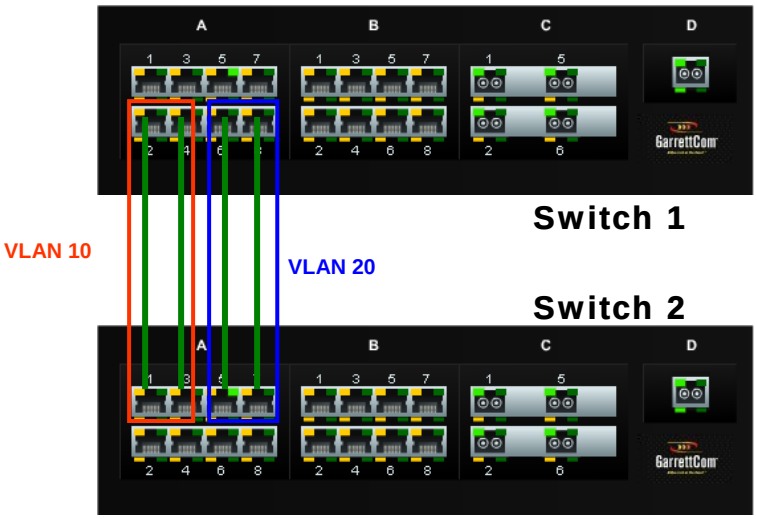


FIGURE 104 – *In this figure, even though the connections are from one module to another, this is still not a valid configuration (for LACP using 4 ports) as the trunk group belongs to two different VLANs.*

However – on each switch, the set of ports can belong to same VLANs as shown in the figure below. While the ports belong to the same VLANs, there is no common VLAN

between the switches and hence the LACPDU cannot be transmitted. This configuration will not work in the LACP mode.

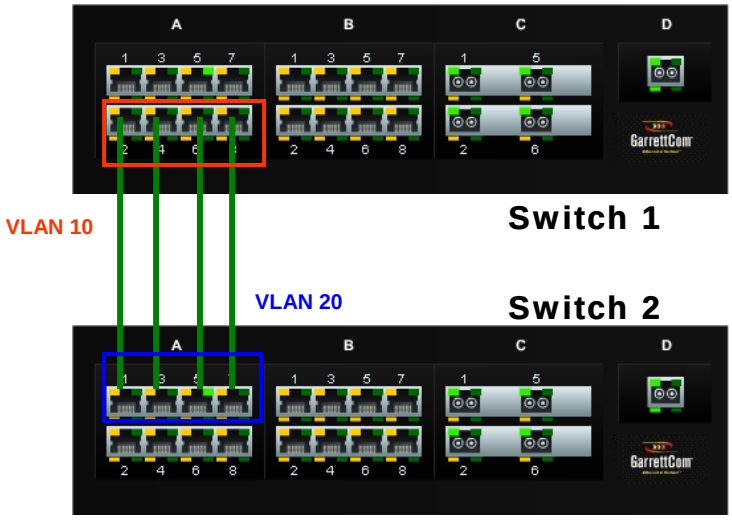


FIGURE 105 - *In the figure above, there is no common VLAN between the two sets of ports, so packets from one VLAN to another cannot be forwarded. There should be at least one VLAN common between the two switches and the LACP port groups.*

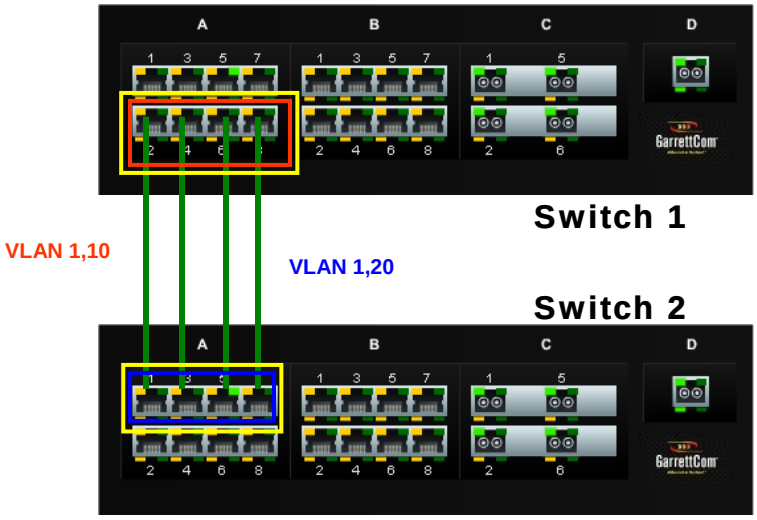


FIGURE 106 – *This configuration is similar to the previous configuration, except there is a common VLAN (VLAN 1) between the two sets of LACP ports. This is a valid configuration.*

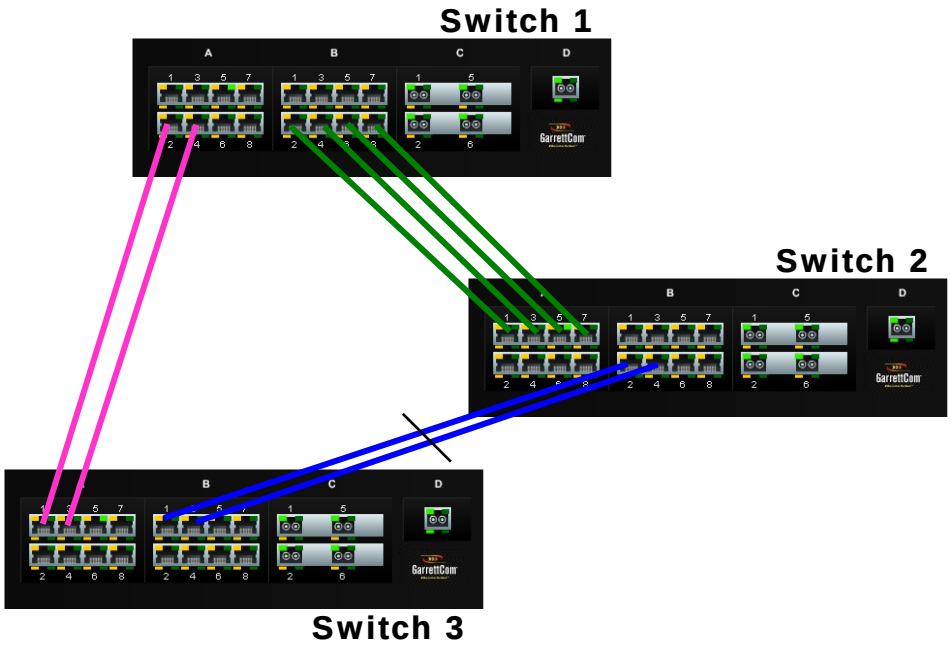
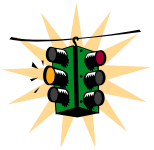


FIGURE 107 – *In the architecture above, using RSTP and LACP allows multiple switches to be configured together in a meshed redundant link architecture. First define the RSTP configuration on the switches. Then define the LACP ports. Then finally connect the ports together to form the meshed redundant link topology as shown above.*



Using the Magnum edge switch with dual-homing allows the edge devices to have link level redundancy as well – bringing the fault tolerance from the network to the edge.

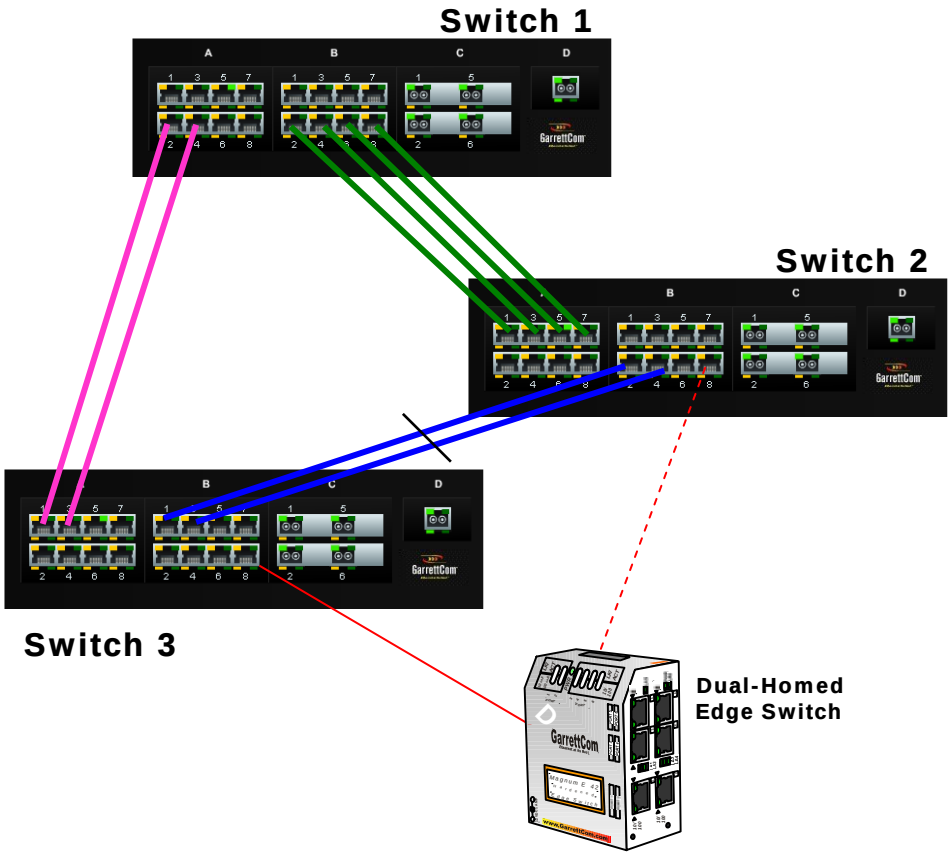
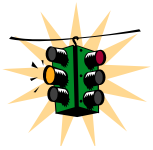


FIGURE 108 – *LACP, along with RSTP/STP brings redundancy to the network core or backbone. Using this reliable core with a dual-homed edge switch brings reliability and redundancy to the edge of the network*



It is recommended not to use LACP with S-Ring at this time.

Since S-Ring and LACP use the same BPDUs (called LACPDUs), the architecture shown below is not supported in this release.

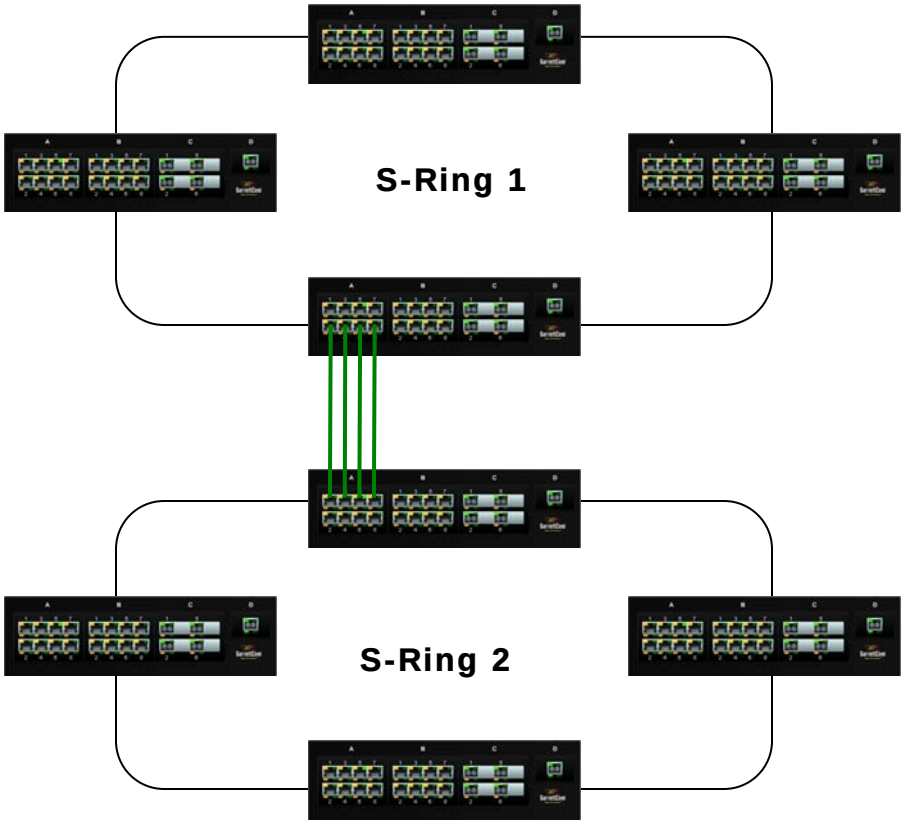


FIGURE 109 – *This architecture is not recommended*

LACP can be used for creating a reliable network between two facilities connected via a wireless bridge. As shown in the figure below, four trunk ports are connected to four wireless bridge pairs. This increases the effective throughput of the wireless connections and also increases the reliability. If one of the bridges were to stop functioning, the other three will continue to operate, providing a very reliable infrastructure.

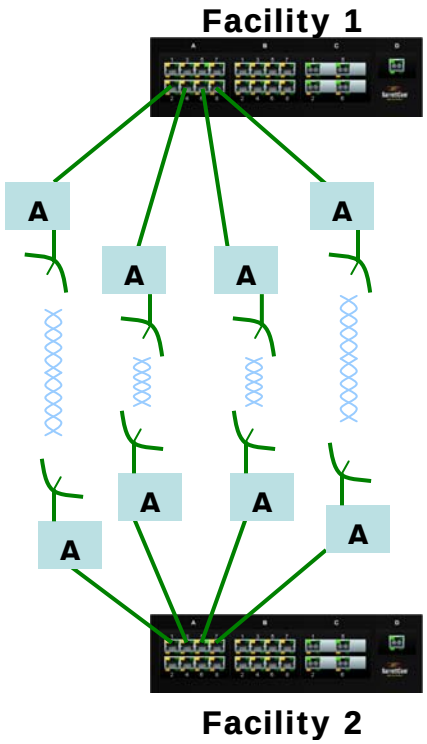


FIGURE 110 – *Creating a reliable infrastructure using wireless bridges (between two facilities) and LACP. "A" indicates a Wi-Fi wireless Bridge or other wireless Bridges.*

The list of commands to configure, edit and manage LACP on the Magnum 6K family of switches is the following:

Syntax **lacp** - *enable the LACP configuration module within CLI*

Syntax **lacp <enable | disable>** - *enable or disable LACP*[7]

Syntax **add port=<number|list|range> [priority=<0-65535>]** – *add the specified list of ports to form the logical LACP trunk. Default value for priority is 32768. The lower the value assigned to priority, the higher the priority. The port with the highest priority is the primary port.*

Syntax **del port=<number|list|range>** - *delete specified ports from the LACP membership*

Syntax **edit port=<number|list|range> [priority=<priority>]** - *edit the membership of the ports specified. The priority can be from 0 – 65535*

Syntax **show lacp** – *displays the status and other relevant LACP information*

Some other definitions are worth noting are primary port. Primary port is the port over which specific traffic like Multicast (IGMP), unknown Unicast and broadcast traffic is transmitted. As shown by the add port command, the port with

[7] Before enabling, please ensure that the correct ports are configured. If network connectivity is lost due to a port being configured as a LACP port, you will need to physically access the switch via the console to correct this error.

the lowest priority value has the highest priority and is designated as the primary port. If traffic analysis is required, it is recommended to mirror the primary port (and physically disconnect the other ports if all traffic needs to be captured).

If multiple ports have the same priority, the first port physically connected becomes the primary port. In case the ports are already connected, the port with the lowest port count becomes the primary port i.e. if ports 4, 5, 6 are designated as the LACP group, port 4 would become the primary port.

If the primary port fails, the next available secondary port is designated as the primary port. So in the example above, if port 4 fails, port 5 will be designated as the primary port.

```
Magnum6K25# show lacp
 LACP is Disabled.

Magnum6K25# lacp

Magnum6K25(lacp)## add port=14,15,16

 Error : LACP is disabled.
Magnum6K25(lacp)## lacp enable

 LACP Enabled.
Magnum6K25(lacp)## add port=13-16

 Port(s) added successfully.
Magnum6K25(lacp)## show lacp

Orphan Ports:

 Port  Priority  Trunk
 ====================
  13    32768  Link Down
  14    32768  Link Down
  15    32768  Link Down
  16    32768  Peer Not a Trunk

Magnum6K25(lacp)## del port=16

 Port(s) deleted successfully.
Magnum6K25(lacp)## show lacp

Orphan Ports:

 Port  Priority  Trunk
 ====================
  13    32768  Link Down
  14    32768  Link Down
```

Need to enable LACP before ports can be added to the trunk group

Indicates no LACP BPDU can be received from this port. This port was in use and was an error to add this. The next few steps delete this port and add the proper port. See other messages below.

```
   15     32768  Link Down


Magnum6K25(lacp)## add port=12

 Port(s) added successfully.
Magnum6K25(lacp)## show lacp

Orphan Ports:

 Port  Priority  Trunk
 ====================
   12     32768  Link Down
   13     32768  Link Down
   14     32768  Link Down
   15     32768  Link Down


Magnum6K25(lacp)## exit

Magnum6K25# show lacp

Orphan Ports:

 Port  Priority  Trunk
 ====================
   12     32768  Link Down
   13     32768  Link Down
   14     32768  Link Down
   15     32768  Link Down


Magnum6K25#
```

FIGURE 111 – *Configuring LACP*

The error messages received when a trunk port is not configured properly are as follows:

Link Down	Link is down or the cable is not connected
Half duplex	A Half Duplex port – Half Duplex ports cannot participate in LACP
Loop Detected	Indicates the other side does not have LACP configured. Without LACP configured on both switches, the network will create an Ethernet loop.
Peer Not a Trunk	When no LACPDU was received (or cannot be received) from the peer. This maybe due to the fact that the port is already in use or is shutdown or not available
Speed Mismatch	All ports in a trunk should have the same speed. If one port's speed does not match the other ports, this specific port cannot join the port group.
Trunk Mismatch	The other switch sent a BPDU which did not match the trunk information associated with this port. This happens when the port is connected to a different switch, or a different module in the Magnum 6K switch

The output of the LACP command in the network shown below

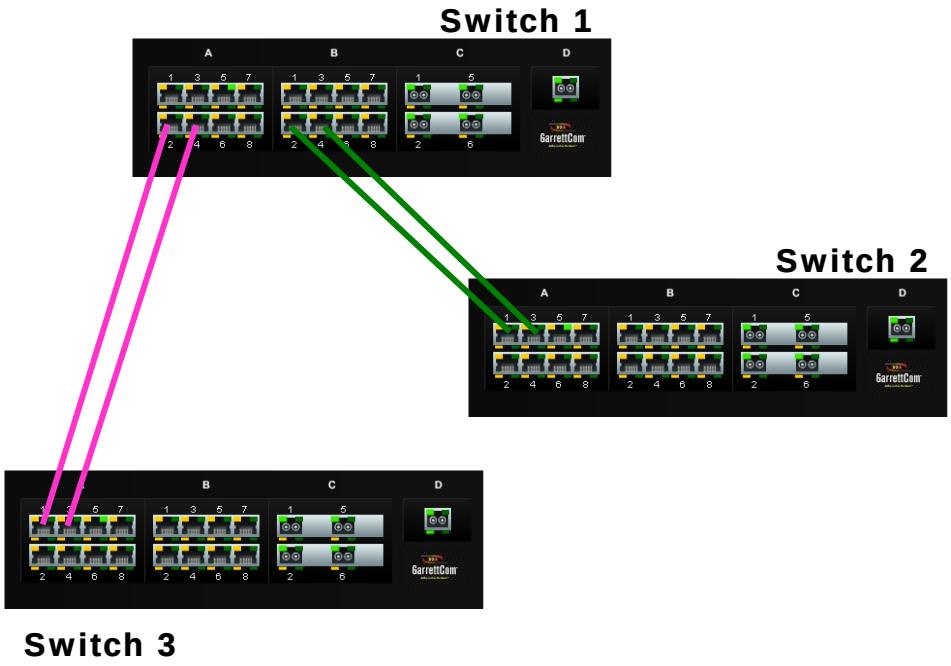


FIGURE 112 – *The network for the 'show lacp' command listed below*

In the figure shown above, Switch 1 has ports 11 and 15 forming the first trunk, connecting to Switch 3. Switch 1 also has ports 17 and 23 forming the second trunk on Switch 2. The 'show lacp' command was executed on Switch 1.

```
Magnum 6K(lacp)## show lacp

 Trunk Id            : 1
 Trunk Status        : Trunk Active
 Primary Port        : 11
 Trunk Partner       : 00:20:06:25:11:40

Member Ports:

 Port  Priority  Trunk
 =====================
  11    32768  Primary Port
  15    32768  Member Port

 Trunk Id            : 2
 Trunk Status        : Trunk Active
 Primary Port        : 17
 Trunk Partner       : 00:20:06:25:72:90

Member Ports:

 Port  Priority  Trunk
```

Unique ID of trunk

MAC address of Switch 3

Ports belonging to this trunk

```
====================
 17    32768  Primary Port
 23    32768  Member Port
```

FIGURE 113 – *LACP information over a network*

List of commands in this chapter

Syntax **lacp** *- enable the LACP configuration module within CLI*

Syntax **lacp <enable | disable>** *- enable or disable LACP*

Syntax **add port=<number|list|range> [priority=<0-65535>]** – *add the specified list of ports to form the logical LACP trunk. Default value for priority is 32768. The lower the value assigned to priority, the higher the priority. The port with the highest priority is the primary port (over which certain types of traffic like IGMP is transmitted)*

Syntax **del port=<number|list|range>** *- delete specified ports from the LACP membership*

Syntax **edit port=<number|list|range> [priority=<priority>]** *- edit the membership of the ports specified. The priority can be from 0 – 65535*

Syntax **show lacp** – *displays the status and other relevant LACP information*

Chapter

17

17 – Quality of Service

Prioritize traffic in a network

Quality of Service (QoS) refers to the capability of a network to provide different priorities to different types of traffic. Not all traffic in the network has the same priority. Being able to differentiate different types of traffic and allowing this traffic to accelerate through the network improves the overall performance of the network and provides the necessary quality of service demanded by different users and devices. The primary goal of QoS is to provide priority including dedicated bandwidth.

QoS concepts

The Magnum 6K family of switches supports QoS as specified in the IEEE 802.1p and IEEE 802.1q standards. QoS is important in network environments where there are time-critical applications, such as voice transmission or video conferencing, which can be adversely effected by packet transfer delays or other latency in a network.

Most switches today implement buffers to queue incoming packets as well as outgoing packets. In a queue mechanism, normally the packet which comes in first leaves first (FIFO) and all the packets are serviced accordingly. Imagine, if each packet had a priority assigned to it. If a packet with a higher priority than other packets were to arrive in a queue, the packet would be given a precedence and moved to the head of the queue and would go out as soon as possible. The packet is thus preempted from the queue and this method is called preemptive queuing.

Preemptive queuing makes sense if there are several levels of priorities, normally more than two. If there are too many levels, then the system has to spend a lot of time managing the preemptive nature of queuing. IEEE 802.1p defines and uses eight levels of priorities. The eight levels of priority are enumerated 0 to 7, with 0 the lowest priority and 7 the highest.

To make the preemptive queuing possible, most switches implement at least two queue buffers. The Magnum 6K family of switches has two priority queues, 1 (low) and 0 (high).When tagged packets enter a switch port, the switch responds by placing

the packet into one of the two queues, and depending on the precedence levels the queue could be rearranged to meet the QoS requirements.

QoS refers to the level of preferential treatment a packet receives when it is being sent through a network. QoS allows time sensitive packets such as voice and video, to be given priority over time insensitive packets such as data. Differentiated Services (DiffServ or DS) are a set of technologies defined by the IETF (Internet Engineering Task Force) to provide quality of service for traffic on IP networks.

DiffServ and QoS

DiffServ is designed for use at the edge of an Enterprise where corporate traffic enters the service provider environment. DiffServ is a layer-3 protocol and requires no specific layer-2 capability, allowing it to be used in the LAN, MAN, and WAN. DiffServ works by tagging each packet (at the originating device or an intermediate switch) for the requested level of service it requires across the network.

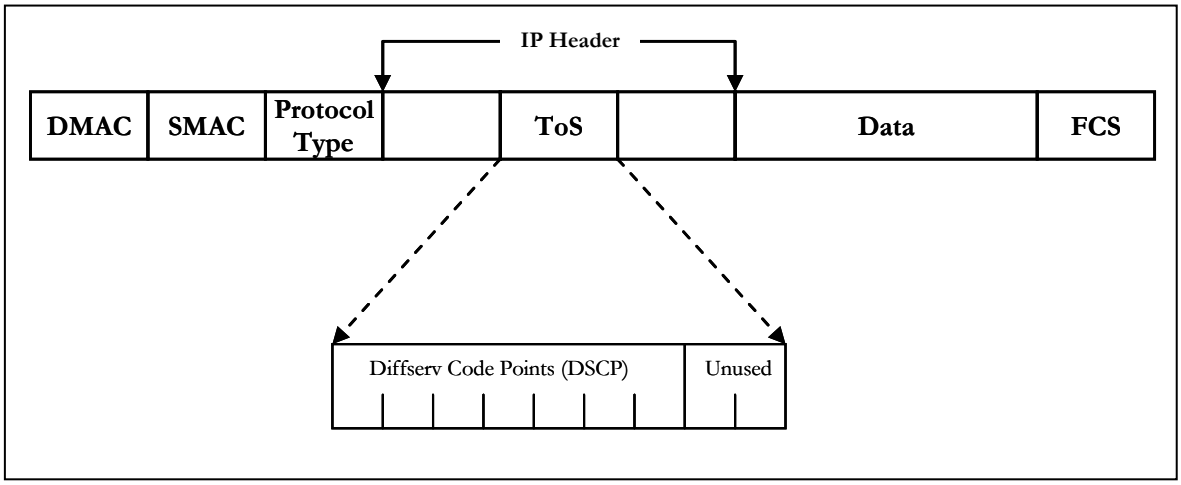


FIGURE 114 – *ToS and DSCP*

DiffServ inserts a 6-bit DiffServ code point (DSCP) in the Type of Service (ToS) field of the IP header, as shown in the picture above. Information in the DSCP allows nodes to determine the Per Hop Behavior (PHB), which is an observable forwarding behavior for each packet. PHBs are defined according to:

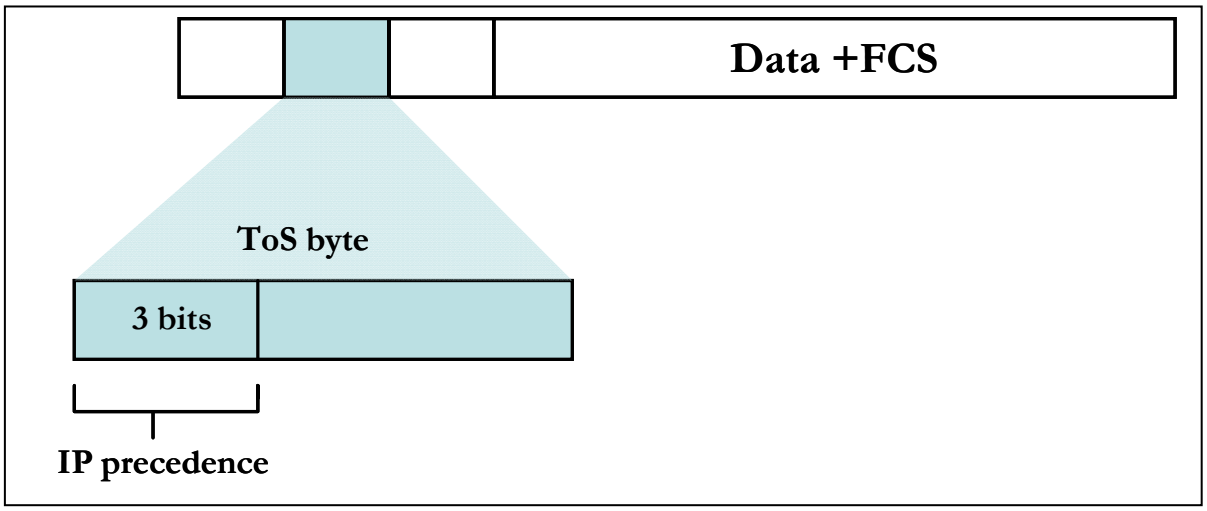
- Resources required (e.g., bandwidth, buffer size)
- Priority (based on application or business requirements)
- Traffic characteristics (e.g., delay, jitter, packet loss)

Nodes implement PHBs through buffer management and packet scheduling mechanisms. This hop-by-hop allocation of resources is the basis by which DiffServ provides quality of service for different types of communications traffic.

IP Precedence

IP Precedence utilizes the three precedence bits in the IPv4 header's Type of Service (ToS) field to specify class of service for each packet. You can partition traffic in up to eight classes of service using IP precedence. The queuing technologies throughout the network can then use this signal to provide the appropriate expedited handling.

FIGURE 115 - *IP Precedence ToS Field in an IP Packet Header*



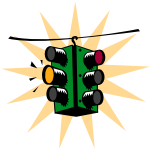
The 3 most significant bits (correlating to binary settings 32, 64, and 128) of the Type of Service (ToS) field in the IP header constitute the bits used for IP precedence. These bits are used to provide a priority from 0 to 7 for the IP packet.

Because only 3 bits of the ToS byte are used for IP precedence, you need to differentiate these bits from the rest of the ToS byte.

The Magnum 6K family of switches has the capability to provide QoS at Layer 2. At Layer 2, the frame uses Type of Service (ToS) as specified in IEEE 802.1p . ToS uses 3 bits, just like IP precedence, and maps well from Layer 2 to layer 3, and vice versa.

The switches have the capability to differentiate frames based on ToS settings. With two queues present - high or low priority queues or buffers in Magnum 6K family of switches, frames can be placed in either queue and serviced via the weight set on all ports. This placement of queues, added to the weight set plus the particular tag setting on a packet allows each queue to have different service levels.

Magnum QoS implementations provide mapping of ToS (or IP precedence) to Class of Service (CoS). A CoS setting in an Ethernet Frame is mapped to the ToS byte of the IP packet, and vice versa. A ToS level of 1 equals a CoS level of 1. This provides end-to-end priority for the traffic flow when Magnum 6K family of switches are deployed in the network.



Not all packets received on a port have high priority. IGMP and BPDU packets have high priority by default.

The Magnum 6K family of switches has the capability to set the priorities based on three different functions. They are

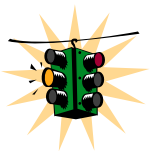
Port QoS: assigns a high priority to all packets received on a port, regardless of the type of packet.

TAG QoS: if a packet contains a tag, the port on which the packet was received then looks to see at which level that tag value is set. Regardless of the tag value, if there is a tag, that packet is automatically assigned high priority (sent to the high priority queue)

ToS QoS: (Layer 3) when a port is set to ToS QoS, the most significant 6-bits of the IPv4 packet (which has 64 bits) are used. If the 6 bits are set to ToS QoS for the specific port number the packet went to, that packet is assigned high priority by that port

Configuring QoS

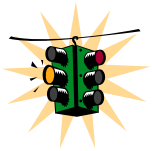
Magnum 6K family of switches support three types of QoS - Port based, Tag based and ToS based.



QoS is disabled by default on the switch. QoS needs to be enabled and configured.

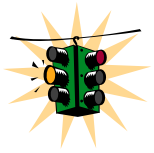
Syntax **qos –** *enter the QoS configuration mode*

Syntax **setqos type=<port|tag|tos|none> [port=<port|list|range>] [priority=<high|low>] [tos=<0-63|list|range>][tag=<0-7|list|range>]** - *depending on the type of QOS, the corresponding field has to be set. For example, for QOS type tag, the tag levels have to be set, and for QOS type ToS, the ToS levels have to be set. If the priority field is not set, it then defaults to low priority. ToS has 64 levels and the valid values are 0-63 and a tagged packet has 8 levels and the valid values are 0-7.*



Setting type to none will clear the QoS settings

Syntax **set-weight weight=<0-7>** - *sets the port priority weight for All the ports. Once the weight is set, all the ports will be the same weight across the switch. The valid value for weight is 0-7.*



A weight is a number calculated from the IP precedence setting for a packet. This weight is used in an algorithm to determine when the packet will be serviced

Syntax **show-portweight** - *display the weight settings on a port*

As mentioned previously, the switch is capable of detecting higher-priority packets marked with precedence by the IP forwarder and can schedule them faster, providing superior response time for this traffic. The IP Precedence field has values between 0 (the default) and 7. As the precedence value increases, the algorithm allocates more bandwidth to that traffic to make sure that it is served more quickly when congestion occurs. Magnum 6K family of switches can assign a weight to each flow, which determines the transmit order for queued packets. In this scheme, lower weights (set on all ports) are provided more service. IP precedence serves as a divisor to this weighting factor. For instance, traffic with an IP precedence field value of 7 gets a lower weight than traffic with an IP Precedence field value of 3, and thus has priority in the transmit order.

Once the port weight is set, the hardware will interpret the weight setting for all ports as outlined below (assuming the queues are sufficiently filled – if there are no packets, for example, in the high priority queue, packets are serviced on a first come first served - FCFS - basis from the low priority queue).

Setting	Hardware traffic queue behavior
0	No priority – traffic is sent alternately from each queue and packets are queued alternately in each queue
1	Two packets are sent from the HIGH priority queue and one packet from LOW priority queue
2	Four packets are sent from the HIGH priority queue and one packet from LOW priority queue
3	Six packets are sent from the HIGH priority queue and one packet from LOW priority queue
4	Eight packets are sent from the HIGH priority queue and one packet from LOW priority queue
5	Ten packets are sent from the HIGH priority queue and one packet from LOW priority queue
6	Twelve packets are sent from the HIGH priority queue and one packet from LOW priority queue
7	All packets are sent from the HIGH priority queue and none are sent from LOW priority queue

FIGURE 116 - *Port weight settings and the meaning of the setting*

Syntax **show qos [type=<port|tag|tos>] [port=<port|list|range>]** – *displays the QoS settings*

Sometimes it is necessary to change the priority of the packets going out of a switch. For example, when a packet is received untagged and has to be transmitted with an addition of the 802.1p priority tag, the tag can be assigned depending on the untag value set. For example if the untag command is set to port=1 tag=2 priority=low, untagged packets received on that port will be tagged with a priority low upon transmit.

Syntax **set-untag port=<port|list|range> priority=<high|low> tag=<0-7>** - *The 802.1p user priority assigned to untagged received packets to be transmitted as tagged from the priority queue*

```
Magnum6K25# show port

Keys:  E  = Enable              D  = Disable
       H  = Half Duplex         F  = Full Duplex
       M  = Multiple VLAN's     NA = Not Applicable
       LI = Listening           LE = Learning
       F  = Forwarding          B  = Blocking

Port  Name Status  Dplx Media    Link   Speed     Part Auto Vlan  GVRP STP
-------------------------------------------------------------------------------------------------
 9    B1     E       H    10Tx    UP     10        No   E    1     -    -
10    B2     E       H    10Tx    DOWN   10        No   E    1     -    -
11    B3     E       H    10Tx    DOWN   10        No   E    1     -    -
12    B4     E       H    10Tx    DOWN   10        No   E    1     -    -
13    B5     E       F    100Tx   UP     100       No   E    1     -    -
14    B6     E       H    10Tx    DOWN   10        No   E    M     -    -
15    B7     E       H    10Tx    DOWN   10        No   E    1     -    -
16    B8     E       H    10Tx    DOWN   10        No   E    1     -    -

Magnum6K25#qos

Magnum6K25(qos)## setqos type=port port=10 priority=high

Successfully set QOS.

Magnum6K25(qos)## setqos type=port port=6 priority=high

Successfully set QOS.

Magnum6K25(qos)## show qos

 ======================================
 PORT    |     QOS      | STATUS
======================================
   1        |        None  |   UP
   2        |        None  |  DOWN
   3        |        None  |  DOWN
   5        |        None  |  DOWN
   6        |        Port   |  DOWN
   7        |        None  |  DOWN
   9        |        None  |  DOWN
```

All traffic on port 10 is sent to the high priority.

```
 10      |      Port   | DOWN
 11      |      None   | DOWN
 13      |      None   | DOWN
 14      |      None   | DOWN
 15      |      None   | DOWN
```

Magnum6K25(qos)## show qos type=port

```
 ================================
  PORT   |  PRIORITY  | STATUS
================================
   1      |     None     |   UP
   2      |     None     | DOWN
   3      |     None     | DOWN
   5      |     None     | DOWN
   6      |     HIGH     | DOWN
   7      |     None     | DOWN
   9      |     None     | DOWN
  10      |     HIGH     | DOWN
  11      |     None     | DOWN
  13      |     None     | DOWN
  14      |     None     | DOWN
  15      |     None     | DOWN
```

Magnum6K25(qos)## setqos port=11 priority=high type=tag tag=6

Successfully set QOS.

All traffic on port 11 is sent to the high priority queue and the QoS tag is set to 6..

Magnum6K25(qos)## show qos

```
 ======================================
  PORT   |     QOS      | STATUS
======================================
   1      |      None   |   UP
   2      |      None   | DOWN
   3      |      None   | DOWN
   5      |      None   | DOWN
   6      |      Port   | DOWN
   7      |      None   | DOWN
   9      |      None   | DOWN
  10      |      Port   | DOWN
  11      |       Tag   | DOWN
  13      |      None   | DOWN
  14      |      None   | DOWN
  15      |      None   | DOWN
```

```
Magnum6K25(qos)## show qos type=tag

=======================================
PORT     | Pri for VPT     | STATUS
         |  76543210       |
=======================================
  1      |  --------       | UP
  2      |  --------       | DOWN
  3      |  --------       | DOWN
  5      |  --------       | DOWN
  6      |  --------       | DOWN
  7      |  --------       | DOWN
  9      |  --------       | DOWN
 10      |  --------       | DOWN
 11      |  LHLLLLLL       | DOWN
 13      |  --------       | DOWN
 14      |  --------       | DOWN
 15      |  --------       | DOWN

Magnum6K25(qos)## setqos port=13 priority=high type=tag tag=5

Successfully set QOS.

Magnum6K25(qos)## show qos type=tag

=======================================
 PORT        | Pri for VPT     | STATUS
             |  76543210       |
 ======================================
  1          |  --------       | UP
  2          |  --------       | DOWN
  3          |  --------       | DOWN
  5          |  --------       | DOWN
  6          |  --------       | DOWN
  7          |  --------       | DOWN
  9          |  --------       | DOWN
 10          |  --------       | DOWN
 11          |  LHLLLLLL       | DOWN
 13          |  LLMLLLLL       | DOWN
 14          |  --------       | DOWN
 15          |  --------       | DOWN

Magnum6K25(qos)## show-portweight

Port priority Weight set to 1 High : 1 Low.

Magnum6K25(qos)## set-weight weight=4

Magnum6K25(qos)## show-portweight

Port priority Weight set to 8 High : 1 Low.
```

The queue behavior is set so that for 8 high priority packets, 1 low priority packet is sent out

```
Magnum6K25(qos)## show qos

=====================================
 PORT    |     QOS      | STATUS
=====================================
  1      |       None   |    UP
  2      |       None   |  DOWN
  3      |       None   |  DOWN
  5      |       None   |  DOWN
  6      |       Port   |  DOWN
  7      |       None   |  DOWN
  9      |       None   |  DOWN
 10      |       Port   |  DOWN
 11      |        Tag   |  DOWN
 13      |        Tag   |  DOWN
 14      |       None   |  DOWN
 15      |       None   |  DOWN
```

FIGURE 117 – *QoS configuration and setup*

List of commands in this chapter

Syntax **qos –** *enter the QoS configuration mode*

Syntax **setqos type=<port|tag|tos|none> [port=<port|list|range>] [priority=<high|low>] [tos=<0-63|list|range>][tag=<0-7|list|range>]** - *depending on the type of QOS, the corresponding field has to be set. For example, for QOS type tag, the tag levels have to be set, and for QOS type ToS, the ToS levels have to be set. If the priority field is not set, it then defaults to low priority. ToS has 64 levels and the valid values are 0-63 and a tagged packet has 8 levels and the valid values are 0-7.*

Syntax **set-weight weight=<0-7>** - *sets the port priority weight for All the ports. Once the weight is set, all the ports will be the same weight across the switch. The valid value for weight is 0-7*

Syntax **show-portweight** - *display the weight settings on a port*

Syntax **show qos [type=<port|tag|tos>] [port=<port|list|range>]** – *displays the QoS settings*

Syntax **set-untag port=<port|list|range> priority=<high|low> tag=<0-7>** - *The 802.1p user priority assigned to untagged received packets to be transmitted as tagged from the priority queue*

Chapter

18

18 – IGMP

Multicast traffic on a network

Internet **G**roup **M**anagement **P**rotocol (IGMP) is defined in RFC 1112 as the standard for IP multicasting in the Internet. It is used to establish host memberships in particular multicast groups on a single network. The mechanisms of the protocol allows a host to inform its local router, using Host Membership Reports that it wants to receive messages addressed to a specific multicast group. All hosts conforming to level 2 of the IP multicasting specification require IGMP.

IGMP concepts[8]

The Magnum 6K family of switches supports IGMP L2 standards as defined by RFC 1112. IGMP is disabled by default and needs to be enabled on the Magnum 6K family of switches. IP multicasting is defined as the transmission of an IP datagram to a "host group", a set of zero or more hosts identified by a single IP destination address. A multicast datagram is delivered to all members of its destination host group with the same "best-efforts" reliability as regular unicast IP datagram, i.e. the datagram is not guaranteed to arrive at all members of the destination group or in the same order relative to other datagram.

The membership of a host group is dynamic; that is, hosts may join and leave groups at any time. There is no restriction on the location or number of members in a host group, but membership in a group may be restricted to only those hosts possessing a private access key. A host may be a member of more than one group at a time. A host need not be a member of a group to send datagram to it.

A host group may be permanent or transient. A permanent group has a well-known, administratively assigned IP address. It is the address and not the membership of the group that is permanent; at any time a permanent group may have any number of members, even zero. A transient group on the other hand is assigned an address dynamically when the group is created, at the request of a host. A transient group ceases to exist, and its address becomes eligible for reassignment, when its membership drops to zero.

[8] Most of the concepts are extracted from RFC 1112 and it is recommended that RFC 1112 be read and understood carefully if IGMP is used or planned for the network.

The creation of transient groups and the maintenance of group membership information is the responsibility of "multicast agents", entities that reside in internet gateways or other special-purpose hosts. There is at least one multicast agent directly attached to every IP network or sub-network that supports IP multicasting. A host requests the creation of new groups, and joins or leaves existing groups, by exchanging messages with a neighboring agent.

The Internet Group Management Protocol (IGMP) is an internal protocol of the Internet Protocol (IP) suite. IP manages multicast traffic by using switches, multicast routers, and hosts that support IGMP. A set of hosts, routers, and/or switches that send or receive multicast data streams to or from the same source(s) is termed a *multicast group*, and all devices in the group use the same multicast group address. The multicast group running version 2 of IGMP uses three fundamental types of messages to communicate:

- **Query:** A message sent from the querier (multicast router or switch) asking for a response from each host belonging to the multicast group. If a multicast router supporting IGMP is not present, then the switch must assume this function in order to elicit group membership information from the hosts on the network. (If you need to disable the querier feature, you can do so through the CLI, using the IGMP configuration MIB. See "Changing the Querier Configuration Setting" on page "Configuring the Querier Function")

- **Report:** A message sent by a host to the querier to indicate that the host wants to be or is a member of a given group indicated in the report message.

- **Leave Group:** A message sent by a host to the querier to indicate that the host has ceased to be a member of a specific multicast group. Thus, IGMP identifies members of a multicast group (within a subnet) and allows IGMP-configured hosts (and routers) to join or leave multicast groups.

When IGMP is enabled on the Magnum 6K family of switches, it examines the IGMP packets it receives:

- To learn which of its ports are linked to IGMP hosts and multicast routers/queriers belonging to any multicast group.

- To become a querier if a multicast router/querier is not discovered on the network.

Once the switch learns the port location of the hosts belonging to any particular multicast group, it can direct group traffic to only those ports, resulting in bandwidth savings on ports where group members do not reside. The following example illustrates this operation.

The figure below shows a network running IGMP.

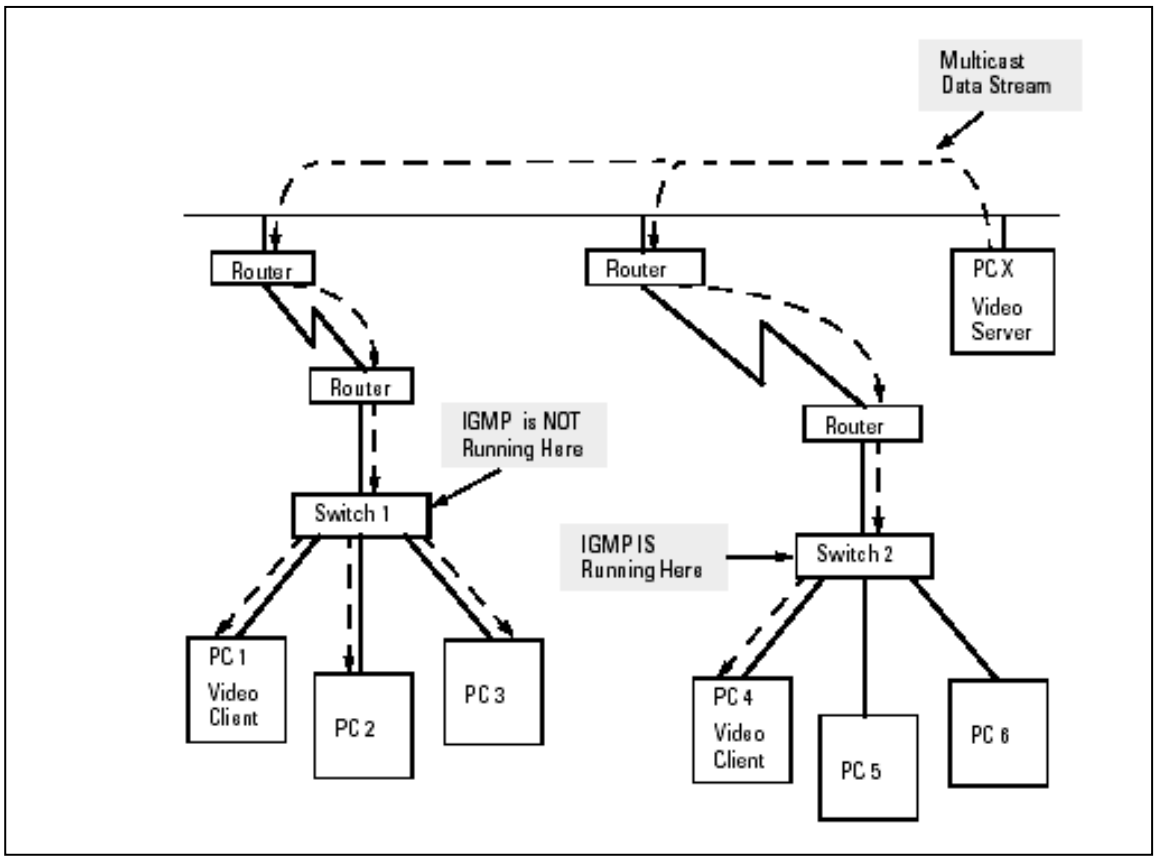


FIGURE 118 – *IGMP concepts – advantages of using IGMP*

- PCs 1 and 4, switch 2, and all of the routers are members of an IP multicast group. (The routers operate as queriers.)
- Switch 1 ignores IGMP traffic and does not distinguish between IP multicast group members and non-members. Thus, it is sending large amounts of unwanted multicast traffic out the ports to PCs 2 and 3.
- Switch 2 is recognizing IGMP traffic and learns that PC 4 is in the IP multicast group receiving multicast data from the video server (PC X). Switch 2 then sends the multicast data only to the port for PC 4, thus avoiding unwanted multicast traffic on the ports for PCs 5 and 6.

The next figure (below) shows a network running IP multicasting using IGMP without a multicast router. In this case, the IGMP-configured switch runs as a querier. PCs 2, 5, and 6 are members of the same IP multicast group. IGMP is configured on switches 3 and 4. Either of these switches can operate as querier because a multicast router is not present on the network. (If an IGMP switch does not detect a querier, it automatically assumes this role, assuming the querier feature is enabled—the default—within IGMP.)

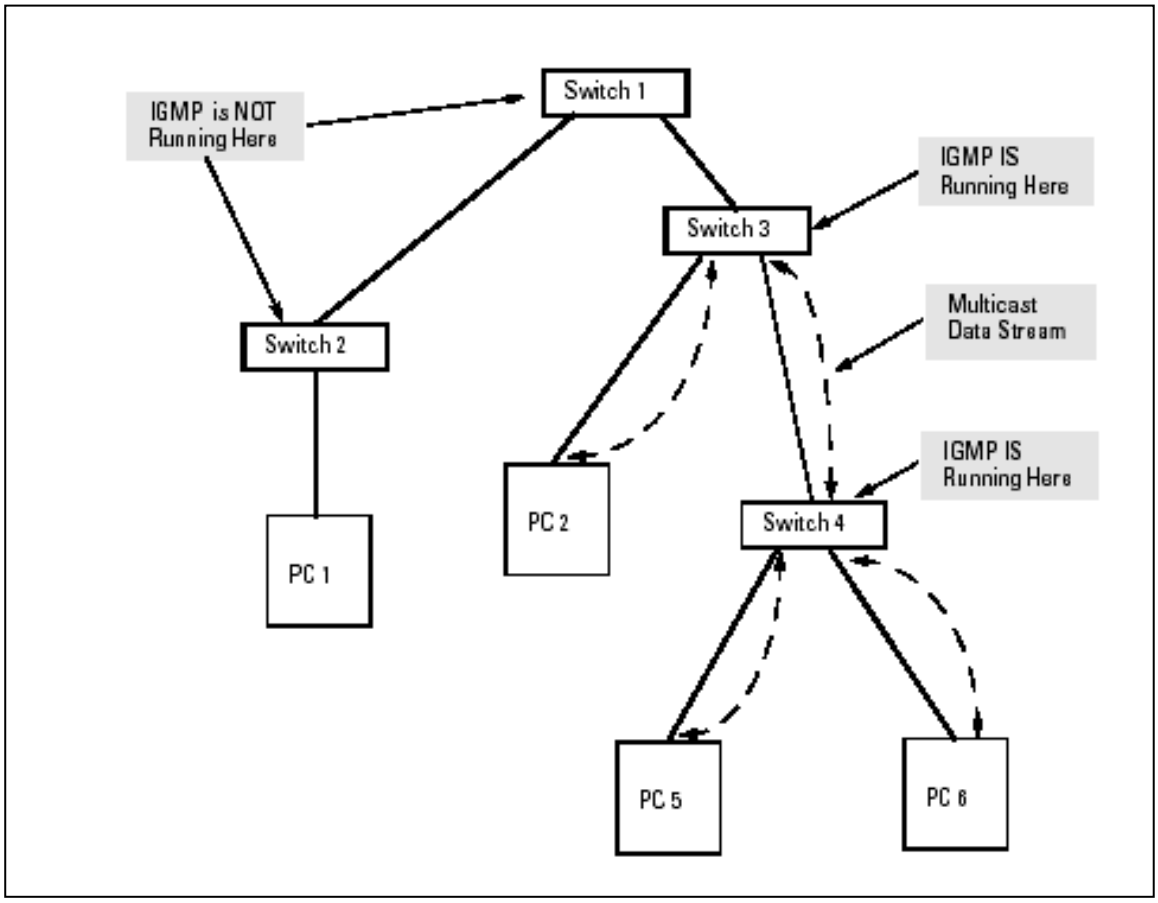


FIGURE 119 – *IGMP concepts – Isolating multicast traffic in a network*

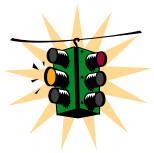
- In the above figure, the multicast group traffic does not go to switch 1 and beyond. This is because either the port on switch 3 that connects to switch 1 has been configured as blocked or there are no hosts connected to switch 1 or switch 2 that belong to the multicast group.
- For PC 1 to become a member of the same multicast group without flooding IP multicast traffic on all ports of switches 1 and 2, IGMP must be configured on both switches 1 and 2, and the port on switch 3 that connects to switch 1 must be unblocked.

IP Multicast Filters - IP multicast addresses occur in the range from 224.0.0.0 through 239.255.255.255 which corresponds to the Ethernet multicast address range of 01005e-000000 through 01005e-7fffff in hexadecimal.

Reserved Addresses Excluded from IP Multicast (IGMP) Filtering – Traffic to IP multicast

groups in the IP address range of 224.0.0.0 to 224.0.0.255 will always be flooded because addresses in this range are "well known" or "reserved" addresses. Thus, if IP Multicast is enabled and there is an IP multicast group within the reserved address range, traffic to that group will be flooded instead of filtered by the switch.

IGMP Support - Magnum 6K family of switches support IGMP version 1 and version 2. The switch can act either as a querier or a nonquerier. The querier router periodically sends general query messages to solicit group membership information. Hosts on the network that are members of a multicast group send report messages. When a host leaves a group, it sends a leave group message. The difference between Version 1 and Version 2 is that version 1 does not have a "Leave" mechanism for the host. Magnum 6K family of switches do pruning when there is a leave message or a time expires on a port, we prune the multicast group membership on that port.



1. The Magnum 6K family of switches can snoop up to 256 Multicast groups. It can be enabled within a port VLAN, tagged VLAN, or no VLAN.
2. IGMP is disabled as a default.

A switch, with IGMP snooping has the behavior similar to a regular switch (default IGMP behavior) i.e. it forwards the multicast stream (packets) to all the ports.

Now, if a device on any of the ports sends a join report or invokes the IGMP Pruning action, the behavior changes. A multicast group is formed in the switch, and the stream is sent only to those ports that actually want to join the stream.

The default behavior of multicasting streams to all ports could create problems when there are a number of multicast streams that enter the switch though a number of different ports. Each stream goes to ALL OTHER ports and creates congestion in the switch.

The mcast command (described below) controls this default behavior. The default setting is "enable". If it is set to "disable", the default behavior is modified so that the stream is not transmitted or multicast to any of the ports until a device joins the stream from that port.

IGMP-L2

IGMP requires a Layer 3 device in the network. What happens if your network has only Layer 2 devices? Can the Layer 2 devices take advantage of the IGMP technology and reduce the overall traffic in the network, without requiring the presence of a Layer 3 device in the network? Using GarrettCom IGMP-L2 (patent pending technology), it is possible to do that.

The benefits of IGMP are clear. The traditional ways of building an IGMP network calls for the IGMP querier to reside on a Layer 3 network device - typically a router or a Layer 3 switch. The end devices (encoders or transmitters) reside on a Layer 2 device and the encoder sends a query/join request to join the specific multicast group. The Magnum 6K family of switches, with the IGMP-L2 enabled, can propagate the query request and also make sure that the multicast

traffic only goes to the ports requesting the traffic. The Magnum 6K family of switches, using IGMP-L2, can perform the similar tasks a Layer 3 device performs for IGMP.

For a Layer 2 IGMP environment, all Magnum 6K family of switches have to be enabled in the IGMP-L2. This is done using the CLI command **'set igmp mode=l2'** which will be described later.

In a Layer 2 network, without IGMP-L2, there is no querier nor is there any capability for the devices to use IGMP snooping to join a multicast group. Thus - the traffic picture from a multicast device would look as shown below.

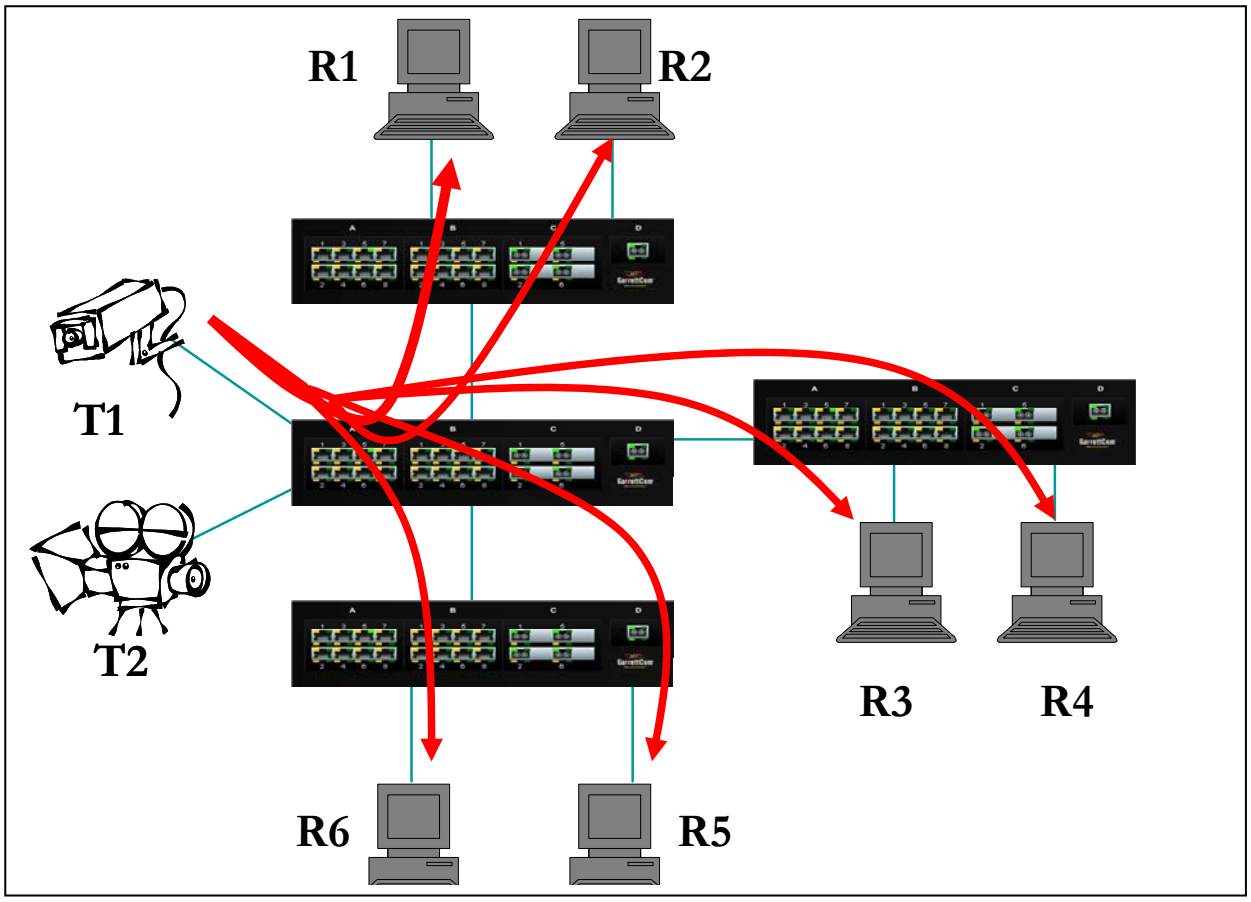


FIGURE 120 - *In a Layer 2 network, an IGMP multicast traffic goes to all the nodes. In the figure, T1, a surveillance camera, using multicast, will send the traffic to all the nodes - R1 through R6 - irrespective of whether they want to view the surveillance traffic or not. The traffic is compounded when additional cameras are added to the network. End result is that users R1 through R6 see the network as heavily loaded and simple day to day operations may appear sluggish.*

With IGMP-L2 enabled on all Magnum 6K family of switches, this situation as shown above is prevented. This is explained in the figure below.

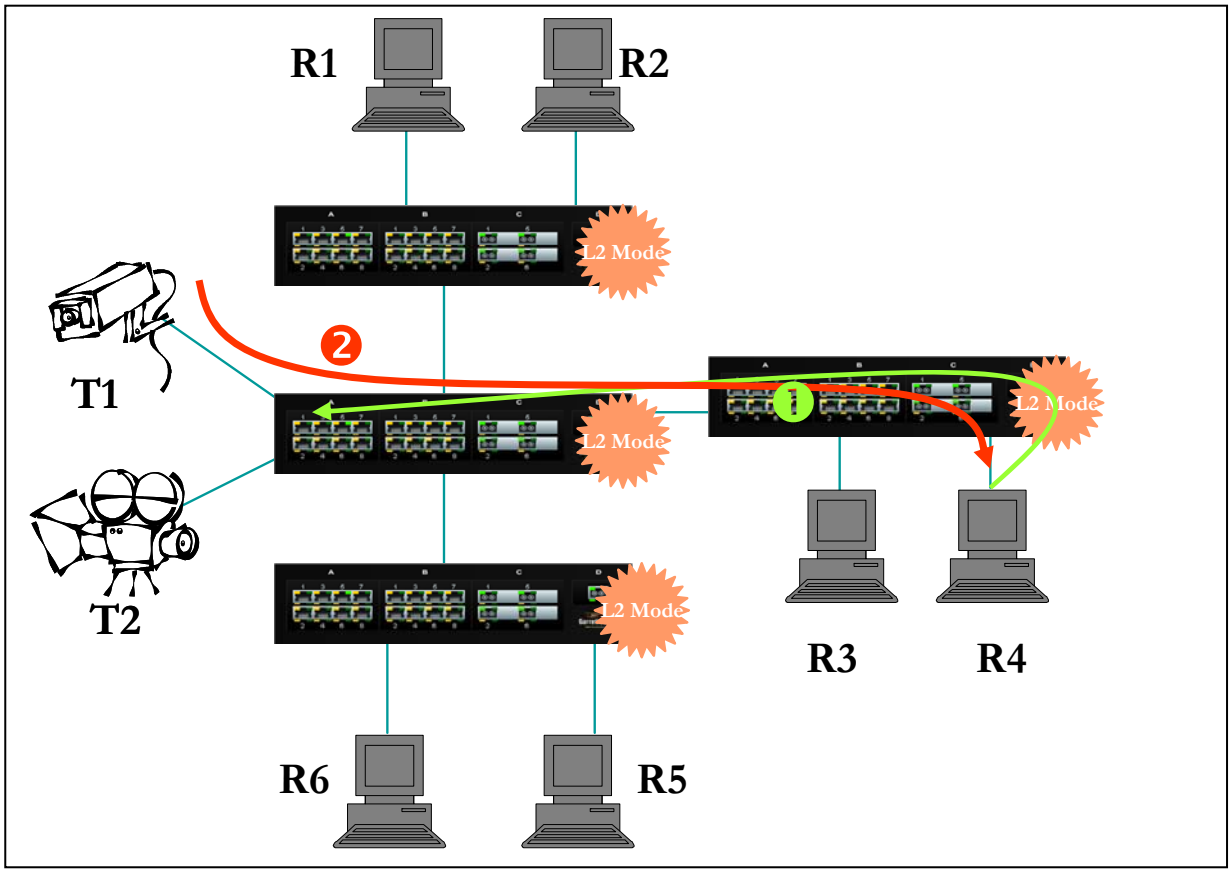


FIGURE 121 - *Using IGMP-L2 on Magnum 6K family of switches, a Layer 2 network can minimize multicast traffic as shown above. Each switch has the IGMPL2 turned on. Each switch can exchange the IGMP query message and respond properly. R4 wants to view surveillance traffic from T1. As shown by (1), a join request is sent by R4. Once the join report information is exchanged, only R4 receives the video surveillance traffic, as shown by (2). No other device on the network gets the video surveillance traffic unless they issue a join request as well.*

Since the query and the join information is exchanged between the neighboring switches, the topology does not matter. The design issue to consider is the timing difference between a topology recovery and IGMP refresh (recovery). GarrettCom Magnum 6K family of switches, connected in an S-Ring topology recovers very rapidly (sub-second recovery). The IGMP requests for updates are sent out every few seconds (depending on the network and the devices on the network). The recovery of the network from a fault situation is much faster than the age out and join request from IGMP. Thus when the Magnum 6K switch network self heals, it is possible that the video may freeze till the (IGMP) device reissues a join request again.

A few additional facts about IGMP L2

- GarrettCom Magnum 6K family of switches configured for IGMP-L2 can perform the Join aggregation required by IGMP
- Multicast forwarding is done based on MAC addresses – so datagram to IP addresses 224.1.2.3 and 239.129.2.3 can be forwarded on the same port groups. It is not possible to do forwarding based on IP addresses as the Magnum 6K family of switches operate at Layer-2
- Magnum 6K family of switches, configured for IGMP L2 are aware of IP address range 224.0.0.x as well as MAC address range 01:00:5e:00:00:xx aware as required by RFC 4541
- The Magnum 6K family of switches, configured for IGMP L2 support forwarding to ports on which multicast routers are attached in addition to the ports where IGMP joins have been received. Thus IGMP L2 and IGMP L3 networks can co-exist
- The Magnum 6K family of switches, configured for IGMP L2 are aware of topology changes, so new queries can be sent or tables updated to ensure robustness

Configuring IGMP

Syntax **igmp** – *IGMP configuration mode*

Syntax **igmp <enable| disable>** *- enable or disable IGMP on the switch*

Syntax **show igmp** – *IGMP operation status*

Syntax **mcast <enable | disable>** *- enable or disable unknown multicast streams. The default is enabled*

Syntax **mode= <normal|l2>** *- set the IGMP mode. Normal is when a L3 device is in the network and is the IGMP root. The IGMP-L2 is used when there is no L3 device in the network*

Syntax **group add ip=<group ip> port=<number|list|range> vlan=<vlanid>** *- add ports to a specific IGMP broadcast*

group del ip=<group ip> - *delete ports from a specific IGMP broadcast group*

```
Magnum6K25# igmp

Magnum6K25(igmp)## igmp enable

  IGMP is enabled

Magnum6K25(igmp)## show igmp


  IGMP State                    : Enabled
  ImmediateLeave                : Disabled
  Querier                       : Enabled
  Querier Interval              : 125
  Querier Response Interval     : 10
  Multicasting unknown streams  : Enabled

Magnum6K25(igmp)## mcast disable

  MCAST is disabled

Magnum6K25(igmp)## show igmp


  IGMP State                    : Enabled
  ImmediateLeave                : Disabled
  Querier                       : Enabled
  Querier Interval              : 125
  Querier Response Interval     : 10
  Multicasting unknown streams  : Disabled


Magnum6K25(igmp)## igmp disable

  IGMP is disabled

Magnum6K25(igmp)## show igmp


  IGMP State                    : Disabled
  ImmediateLeave                : Disabled
  Querier                       : Disabled
  Querier Interval              : 125
  Querier Response Interval     : 10
  Multicasting unknown streams  : Disabled


  Magnum6K25(igmp)##
```

FIGURE 122 – *Enabling IGMP and query the status of IGMP*

The output of "show igmp" provide useful information. The following information is provided:

IGMP State shows if IGMP is turned on (Enable) or off (Disable).

Immediate Leave provides a mechanism for a particular host that wants to leave a multicast group. It disables the port (where the leave message is received) ability to transmit multicast traffic.

Querier shows where the switch is acting a querier or a non-querier. In the example above the switch is the querier.

Querier Interval shows the time period in seconds on which the switch sends general host-query messages.

Querier Response Interval specifies maximum amount of time in seconds that can elapse between when the querier sends a host-query message and when it receives a response from a host.

Syntax **show-group** – *shows the multicast groups*

```
Magnum6K25(igmp)## show-group

GroupIp          PortNo       Timer      LeavePending
-------------------------------------------------------------------------
224.1.0.1          9          155        0
224.0.1.40         9          155        0

Magnum6K25(igmp)##
```

FIGURE 123 – *Displaying IGMP groups*

The output of the "show-group" command displays

Group IP column shows the multicast groups.

Port No shows the port where the multicast group is being detected.

Timer shows the amount of time left in seconds before the group port will be deleted (or will not be able to route multicast traffic) if the switch does not receive a membership report.

Leave Pending column shows the number of leave messages received from this port

Every port can be individually set to three different IGMP modes – Auto, Block and Forward.

- Auto – lets IGMP control whether the port should or should not participate sending multicast traffic
- Block – manually configures the port to always block multicast traffic
- Forward – manually configures the port to always forward multicast traffic

To set the port characteristics, use the set-port in the IGMP configuration command mode

Syntax **set-port port=< port|list|range> mode=<auto|forward|block>** *- set the port characteristics. Block drops the unregistered multicasts. Forward forwards unregistered multicasts*

Syntax **show-port** – *display the port characteristics for IGMP*

Syntax **show-router** – *displays detected IGMP-enabled router ports*

Syntax **set-leave <enable|disable>** *- enables or disables the switch to immediately process a host sending a leave message rather that wait for the timer to expire*

Syntax **set-querier <enable|disable>** *- enables or disables a switch as IGMP querier*

Syntax **set-qi interval=<value>** *- The IGMP querier router periodically sends general host-query messages. These messages are sent to ask for group membership information. This is sent to the all-system multicast group address, 224.0.0.1. The default value is 125 seconds. The valid range can be from 60 to 127 seconds.*

Syntax **set-qri interval=<value> -** *The query response interval is the maximum amount of time that can elapse between when the querier router sends a host-query message and when it receives a response from a host. The Default value is 10 seconds. The Range can be from 2 to 270 seconds. Restrictions apply to the maximum value because of an internal calculation that is dependent on the value of the Query Interval.*

```
Magnum6K25# igmp

Magnum6K25(igmp)## set-port port=10-12 mode=forward

 Port mode is set.

Magnum6K25(igmp)## set-port port=14-16 mode=block

 Port mode is set.

Magnum6K25(igmp)## show-port

        ----------------------------------
        Port     |     Mode
        ----------------------------------
         09              Auto
```

```
        10          Forwarding
        11          Forwarding
        12          Forwarding
        13          Auto
        14          Blocking
        15          Blocking
        16          Blocking

Magnum6K25(igmp)## igmp enable

 IGMP is enabled

Magnum6K25(igmp)## show-router

 RouterIp        PortNo    Timer
 ------------------------------------
 10.21.1.250        9        25

Magnum6K25(igmp)## set-leave enable

 IGMP immediate leave status is enabled

Magnum6K25(igmp)## show igmp

 IGMP State                  : Enabled
 ImmediateLeave              : Enabled
 Querier                     : Enabled
 Querier Interval            : 125
 Querier Response Interval   : 10

Magnum6K25(igmp)## set-leave disable

 IGMP immediate leave status is disabled

Magnum6K25(igmp)## show igmp

 IGMP State                  : Enabled
 ImmediateLeave              : Disabled
 Querier                     : Enabled
 Querier Interval            : 125
 Querier Response Interval   : 10

Magnum6K25(igmp)## set-querier enable

 IGMP querier status is enabled

Magnum6K25(igmp)## show igmp

 IGMP State                  : Enabled
 ImmediateLeave              : Disabled
 Querier                     : Enabled
 Querier Interval            : 125
```

```
  Querier Response Interval        : 10

Magnum6K25(igmp)## set-querier disable

  IGMP querier status is disabled

Magnum6K25(igmp)## show igmp

  IGMP State                       : Enabled
  ImmediateLeave                   : Disabled
  Querier                          : Disabled
  Querier Interval                 : 125
 Querier Response Interval         : 10

Magnum6K25(igmp)## set-qi interval=127

Query interval successfully set

Magnum6K25(igmp)## show igmp

  IGMP State                        : Enabled
  ImmediateLeave                    : Disabled
  Querier                           : Disabled
  Querier Interval                   127
  Querier Response Interval         : 10

Magnum6K25(igmp)## set-qri interval=11

  Query response interval successfully set

Magnum6K25(igmp)## show igmp

  IGMP State                       : Enabled
  ImmediateLeave                   : Disabled
  Querier                          : Disabled
  Querier Interval                 : 125
  Querier Response Interval        : 11
```

FIGURE 124 – *Configuring IGMP*

Once IGMP is set, groups of broadcasts can be defined using the group command.

```
Magnum6K25(igmp)## group add ip=239.0.1.10 port=10-12

  Static Group Added

Magnum6K25(igmp)## group add ip=239.0.10.10 port=10-15

  Static Group Added

Magnum6K25(igmp)## show-group
```

```
GroupIp          PortNo   Timer      Vlanid   LeavePending
-------------------------------------------------------------------------------
0.0.0.0            1       155          1         0
239.0.1.10         10      STATIC       0         0
239.0.1.10         11      STATIC       0         0
239.0.1.10         12      STATIC       0         0
239.0.10.10        10      STATIC       0         0
239.0.10.10        11      STATIC       0         0
239.0.10.10        12      STATIC       0         0
239.0.10.10        13      STATIC       0         0
239.0.10.10        14      STATIC       0         0
239.0.10.10        15      STATIC       0         0

Magnum6K25(igmp)## group del ip=239.0.10.10

 Group Deleted

Magnum6K25(igmp)## show-group


GroupIp          PortNo   Timer      Vlanid   LeavePending
-------------------------------------------------------------------------------
0.0.0.0            1       155          1         0
239.0.1.10         10      STATIC       0         0
239.0.1.10         11      STATIC       0         0
239.0.1.10         12      STATIC       0         0

Magnum6K25(igmp)##
```

FIGURE 125 – *Adding broadcast groups using the group command*

For setting IGMP L2 mode, make sure the set of commands listed below are executed on all the Magnum switches participating in the L2. The command to use is

Syntax **mode <normal | L2>** - *As discussed earlier, set the IGMP to use IGMP-L2 or normal IGMP. Note – the "L" in "L2" is in lower case and is shown in upper case for clarity*

```
Magnum6K25# igmp

Magnum6K25(igmp)## mode L2

  IGMP set to L2 Mode.

Magnum6K25(igmp)## show igmp
 IGMP State                    : Disabled
 ImmediateLeave                : Disabled
 Querier                       : L2 Mode
 Querier Interval              : 125
 Querier Response Interval     : 10
 Multicasting unknown streams  : Disabled
```

```
Magnum6K25(igmp)## mode normal

 IGMP set to Normal Mode.

Magnum6K25(igmp)## exit
Magnum6K25#
```

FIGURE 126 - *Setting IGMP-L2*

List of commands in this chapter

Syntax **igmp** – *IGMP configuration mode*

Syntax **igmp <enable|disable>** - *enable or disable IGMP on the switch*

Syntax **show igmp** – *IGMP operation status*

Syntax **mcast <enable | disable>** - *enable or disable unknown multicast streams. The default is enabled*

Syntax **set igmp mode=<normal|l2>** - *set the IGMP mode. Normal is when a L3 device is in the network and is the IGMP root. The IGMP-L2 is used when there is no L3 device in the network*

Syntax **group add ip=<group ip> port=<number|list|range> vlan=<vlanid>** - *add ports to a specific IGMP broadcast*
group del ip=<group ip> - *delete ports from a specific IGMP broadcast group*

Syntax **show-group** – *shows the multicast groups*

Syntax **set-port port=< port|list|range> mode=<auto|forward|block>** - *set the port characteristics. Block drops the unregistered multicasts. Forward forwards unregistered multicasts*

Syntax **show-port** – *display the port characteristics for IGMP*

Syntax **show-router** – *displays detected IGMP-enabled router ports*

Syntax **set-leave <enable|disable>** - *enables or disables the switch to immediately process a host sending a leave message rather that wait for the timer to expire*

Syntax **set-querier <enable|disable>** - *enables or disables a switch as IGMP querier*

Syntax **set-qi interval=<value>** - *The IGMP querier router periodically sends general host-query messages. These messages are sent to ask for group membership information. This is sent to the all-system multicast*

group address, 224.0.0.1. The default value is 125 seconds. The valid range can be from 60 to 127 seconds.

Syntax **set-qri interval=<value> -** *The query response interval is the maximum amount of time that can elapse between when the querier router sends a host-query message and when it receives a response from a host. The Default value is 10 seconds. The Range can be from 2 to 270 seconds. Restrictions apply to the maximum value because of an internal calculation that is dependent on the value of the Query Interval*

Syntax **mode <normal | L2>** *- Set the IGMP to use IGMP-L2 or normal IGMP. Note – the "L" in "L2" is in lower case and is shown in upper case for clarity*

Chapter 19

19 – GVRP

Generic Attribute Registration Protocol (GARP) VLAN Registration Protocol (GVRP)

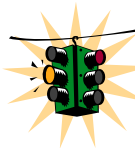
Generic **A**ttribute **R**egistration **P**rotocol (GARP) and VLAN registration over GARP is called GVRP. GVRP is defined in the IEEE 802.1q and GARP in the IEEE 802.1p standards. In order to utilize the capabilities of GVRP, GarrettCom Inc. strongly recommends that the user is familiar with the concepts and capabilities of IEEE 802.1q.

GVRP concepts

GVRP makes it easy to propagate VLAN information across multiple switches. Without GVRP, a network administrator has to go to each individual switch and enable the necessary VLAN information or block specific VLAN's so that the network integrity is maintained. With GVRP this process can be automated.

It is critical that all switches share a common VLAN. This VLAN typically is the default VLAN (VID=1) on most switches and other devices. GVRP uses "GVRP Bridge Protocol Data Units" ("GVRP BPDUs") to "advertise" static VLANs. We refer to GVRP BPDU as an "advertisement".

GVRP enables the Magnum 6K family of switches to dynamically create 802.1q-compliant VLANs on links with other devices running GVRP. This enables the switch to automatically create VLAN links between GVRP-aware devices. A GVRP link can include intermediate devices that are not GVRP-aware. This operation reduces the chances for errors in VLAN configuration by automatically providing VLAN ID (VID) consistency across the network. GVRP can thus be used to propagate VLANs to other GVRP-aware devices instead of manually having to set up VLANs across the network. After the switch creates a dynamic VLAN, GVRP can also be used to dynamically enable port membership in static VLANs configured on a switch.



There must be one common VLAN (that is, one common VID) connecting all of the GVRP-aware devices in the network to carry GVRP packets. GarrettCom Inc. recommends the default VLAN (DEFAULT_VLAN; VID = 1), which is automatically enabled and configured as untagged on every port of the Magnum 6K family of switches. That is, on ports used as GVRP links, leave

the default VLAN set to untagged and configure other static VLANs on the ports as either "Tagged or Forbid**"**. *("Forbid" is discussed later in this chapter.)*

GVRP Operations

A GVRP-enabled port with a Tagged or Untagged static VLAN sends advertisements (BPDUs, or Bridge Protocol Data Units) advertising the VLAN identification (VID). Another GVRP-aware port receiving the advertisements over a link can dynamically join the advertised VLAN. All dynamic VLANs operate as Tagged VLANs. Also, a GVRP-enabled port can forward an advertisement for a VLAN it learned about from other ports on the same switch. However, the forwarding port will not itself join that VLAN until an advertisement for that VLAN is received on that specific port.

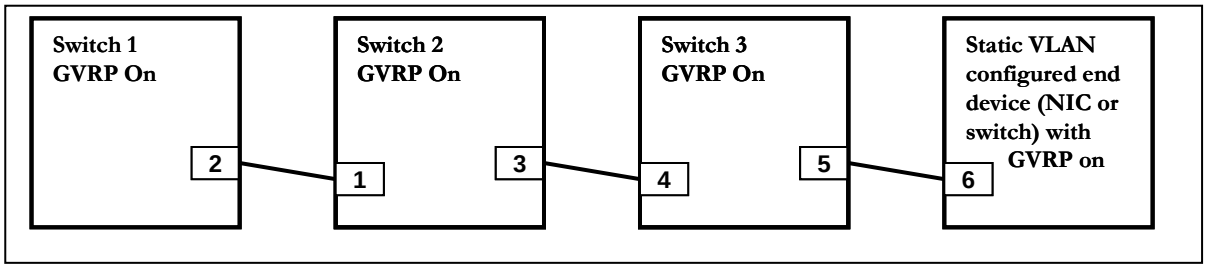
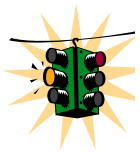


FIGURE 127 – *GVRP operation – see description below*

Switch 1 with static VLANs (VID= 1, 2, & 3). Port 2 is a member of VIDs 1, 2, & 3.

1. Port 2 advertises VIDs 1, 2, & 3
2. On Switch 2 - Port 1 receives advertisement of VIDs 1, 2, & 3 AND becomes a member of VIDs 1, 2, & 3
3. As discussed above, a GVRP enabled port can forward advertisement for a VLAN it learnt about. So port 3 advertises VIDs 1, 2, & 3, but port 3 is NOT a member of VIDs 1, 2, & 3 at this point, nor will it join the VLAN until and advertisement is received
4. On Switch 3, port 4 receives advertisement of VIDs 1, 2, & 3 and becomes a member of VIDs 1, 2, & 3
5. Port 5 advertises VIDs 1, 2,& 3, but port 5 is NOT a member of VIDs 1, 2, & 3 at this point
6. Port 6 on the end device is statically configured to be a member of VID 3. Port 6 advertises VID 3
7. Port 5 receives advertisement
8. Port 4 advertises VID 3
9. Port 3 receives advertisement of VID 3 AND becomes a member of VID 3. (Still not a member of VIDs 1 & 2 as it did not receive any advertisements for VID 1 or 2)
10. Port 1 advertises VID 3 AND becomes a member of VID 3. (Port 1 is still not a member of VIDs 1 & 2)
11. Port 2 receives advertisement of VID 3. (Port 2 was already statically configured for VIDs 1, 2, 3)



If a static VLAN is configured on at least one port of a switch, and that port has established a link with another device, then all other ports of that switch will send advertisements for that VLAN.

In the figure below, tagged VLAN ports on switch "A" and switch "C" advertise VLANs 22 and 33 to ports on other GVRP-enabled switches that can dynamically join the VLANs. A port can learn of a dynamic VLAN through devices that are not aware of GVRP (Switch "B".)

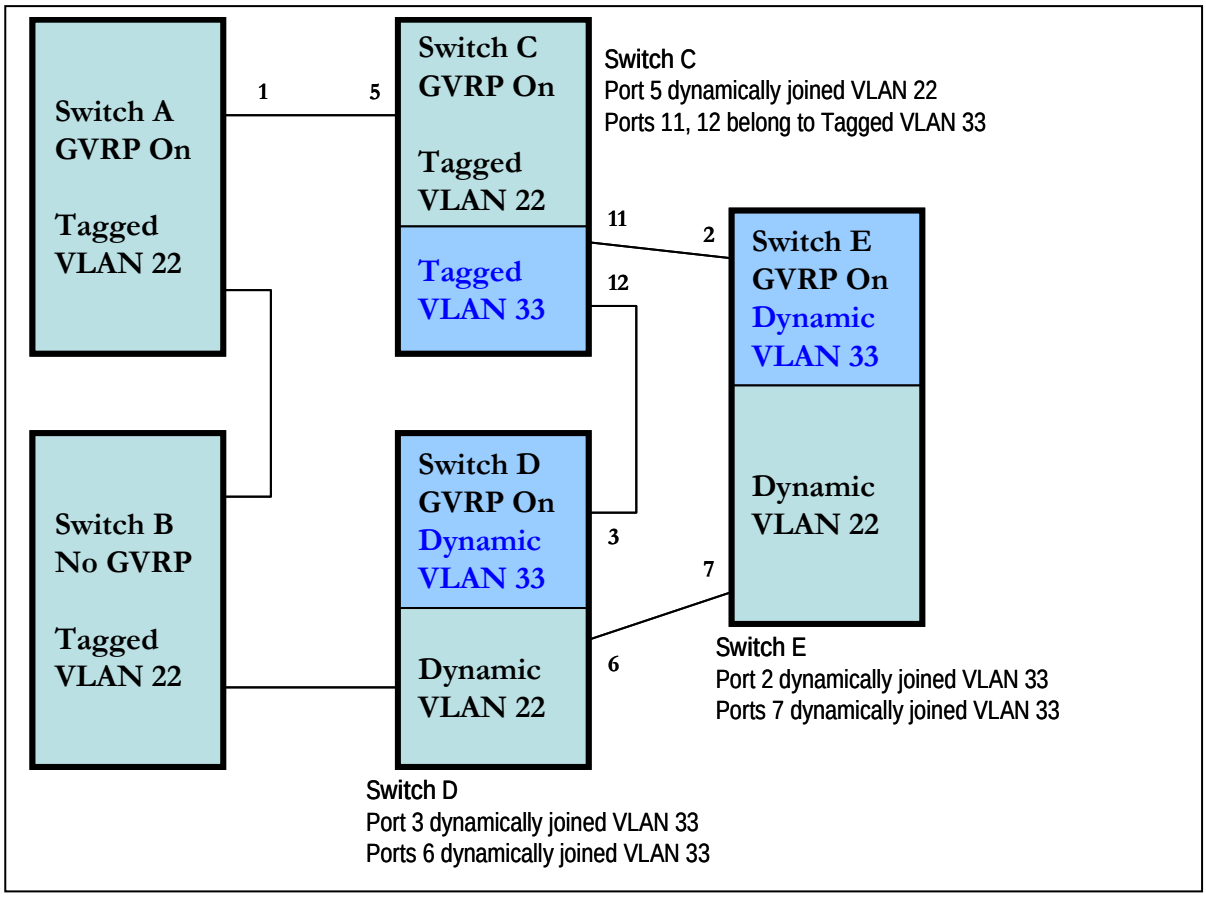
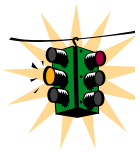


FIGURE 128 – *VLAN Assignment in GVRP enabled switches. Non GVRP enabled switches can impact VLAN settings on other GVRP enabled switches*

An "unknown VLAN" is a VLAN that the switch learns of by GVRP. For example, suppose that port 1 on switch "A" is connected to port 5 on switch "C". Because switch "A" has VLAN 22 statically configured, while switch "C" does not have this VLAN statically configured, VLAN 22 is handled as an "Unknown VLAN" on port 5 in switch "C". Conversely, if VLAN 22 was statically configured on switch C, but port 5 was not a member, port 5 would become a member when advertisements for VLAN 22 were received from switch "A". GVRP provides a per-port join-request option which can be configured.

VLANs must be disabled in GVRP-unaware devices to allow tagged packets to pass through. A GVRP-aware port receiving advertisements has these options:

- If there is no static VLAN with the advertised VID on the receiving port, then dynamically create a VLAN with the same VID as in the advertisement, and allow that VLAN's traffic
- If the switch already has a static VLAN with the same VID as in the advertisement, and the port is configured to learn for that VLAN, then the port will dynamically join the VLAN and allow that VLAN's traffic.
- Ignore the advertisement for that VID and drop all GVRP traffic with that VID
- Don't participate in that VLAN



A port belonging to a tagged or untagged static VLAN has these configurable options:

- Send VLAN advertisements, and also receive advertisements for VLANs on other ports and dynamically join those VLANs
- Send VLAN advertisements, but ignore advertisements received from other ports
- Avoid GVRP participation by not sending advertisements and dropping any advertisements received from other devices

Unknown VLAN Mode	Operations
Learn	Enables the port to dynamically join any VLAN for which it receives and advertisement, and allows the port to forward the advertisement it receives
Block	Prevents the port from dynamically joining a VLAN that is not statically configured on the switch. The port will still forward advertisements that were received by the switch on other ports. Block should typically be used on ports in insecure networks where there is exposure to attack – such as ports where intruders can connect to
Disable	Causes the port to ignore and drop all the advertisements it receives from any source

FIGURE 129 – *Port settings for GVRP operations*

The CLI command "**show-vlan"** shows a switch's current GVRP configuration, including the unknown VLANs.

```
Magnum6K25# gvrp

Magnum6K25(gvrp)## show-vlan
```

```
==========================================
 VLAN ID  | NAME          |  VLAN       STATUS
==========================================
    1     | Default VLAN |  Static      Active
    2     | Blue         |  Static      Active
   10     | dyn10        |  Dynamic     Active

Magnum6K25(gvrp)##
```

FIGURE 130 – *Command to check for dynamically assigned VLANs*

Note that port 10 must be enabled and configured to learn for it to be assigned to the dynamic VLAN. To send advertisements, one or more tagged or untagged static VLANs must be configured on one (or more) switches with GVRP enabled. MNS-6K allows a dynamic VLAN to be converted to a static VLAN. The command to use is

Syntax **static vlan=<VID>** - *convert a dynamic VLAN to a static VLAN*

Note **"show vlan type=tag"** will display VID in case the VID is not known.

```
Magnum6K25# gvrp

Magnum6K25(gvrp)## show-vlan

==========================================
 VLAN ID  | NAME          |  VLAN       STATUS
==========================================
    1     | Default VLAN |  Static      Active
    2     | Blue         |  Static      Active
   10     | dyn10        |  Dynamic     Active

Magnum6K25(gvrp)## static vlan=10

Magnum6K25(gvrp)## show-vlan

==========================================
 VLAN ID  | NAME          |  VLAN       STATUS
==========================================
    1     | Default VLAN |  Static      Active
    2     | Blue         |  Static      Active
   10     | dyn10        |  Static      Active
```

VLAN 10 is converted to a static VLAN

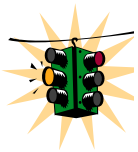
FIGURE 131 – *Converting a dynamic VLAN to a static VLAN*

Per Port "unknown VLAN" (GVRP)	Per-Port Static VLAN Options		
	Tagged or Untagged	Auto	Forbid

configuration			
Learn	Generate advertisements. Forward advertisements for other VLANs Receive advertisements and dynamically join any advertised VLAN	Receive advertisements and dynamically join any advertised VLAN that has the same VID as the static VLAN	Do not allow the port to become a member of this VLAN
Block	Generate advertisements Forward advertisements received from other ports to other VLANs Do not dynamically join any advertised VLAN	Receive advertisements and dynamically join any advertised VLAN that has the same VID	Do not allow the VLAN on this port
Disable	Ignore GVRP and drop all GVRP advertisements	Ignore GVRP and drop all GVRP advertisements	Do not allow the VLAN on this port

FIGURE 132 – *GVRP options*

As the above table indicates a port that has a tagged or untagged static VLAN has the option to both generate advertisements and dynamically join other VLANs.



The unknown VLAN parameters are configured on a per interface basis using the CLI. The tagged, untagged, Auto, and Forbid options are configured in the VLAN context. Since dynamic VLANs operate as tagged VLANs, and it is possible that a tagged port on one device may not communicate with an untagged port on another device, GarrettCom Inc. recommends that you use Tagged VLANs for the static VLANs.

A dynamic VLAN continues to exist on a port for as long as the port continues to receive advertisements of that VLAN from another device connected to that port or until you:

- Convert the VLAN to a static VLAN
- Reconfigure the port to Block or Disable
- Disable GVRP
- Reboot the switch

The time-to-live for dynamic VLANs is 10 seconds. That is, if a port has not received an advertisement for an existing dynamic VLAN during the last 10 seconds, the port removes itself from that dynamic VLAN.

Configuring GVRP

The commands used for configuring GVRP are

Syntax **show gvrp** *- shows whether GVRP is disabled, along with the current settings for the maximum number of VLANs and the current Primary VLAN*

Syntax **gvrp <enable|disable>** *- enable or disable GVRP*

Syntax **show-vlan** – *list all the VLANs (including dynamic VLANs) on the switch*

Syntax **set-ports port=<port|list|range> state=<learn|block|disable>** *- set the state of the port to learn, block or disable for GVRP. Note the default state is disable*

Syntax **static vlan=<VID>** *- convert a dynamic VLAN to a static VLAN*

Syntax **set-forbid vlan=<tag vlanid> forbid=<port-number|list|range>** *- sets the forbid GVRP capability on the ports specified*

Syntax **show-forbid** – *display the ports with GVRP forbid capabilities*

```
Magnum6K25# gvrp

Magnum6K25(gvrp)#show gvrp

GVRP Status :  Enabled

Magnum6K25(gvrp)##gvrp disable

 GVRP is now disabled

Magnum6K25(gvrp)##gvrp enable

  GVRP enabled

Magnum6K25(gvrp)## show-vlan

 ========================================
  VLAN ID      | NAME          |  VLAN       STATUS
 ========================================
     1         |  Default VLAN |  Static       Active
     2         |  Blue         |  Static       Active
    10         |  dyn10        |  Dynamic      Active

Magnum6K25(gvrp)## static vlan=10

Magnum6K25(gvrp)## show-vlan

 ========================================
  VLAN ID      | NAME          |  VLAN       STATUS
 ========================================
     1         |  Default VLAN |  Static       Active
     2         |  Blue         |  Static       Active
    10         |  dyn10        |  Static       Active
```

```
Magnum6K25(gvrp)## set-forbid vlan=2 forbid=11-15

Magnum6K25(gvrp)## show-forbid

=========================================
 VLAN ID       |  FORBIDDEN PORTS
=========================================
    1          | None
    2          | 11, 12, 13, 14, 15
```

FIGURE 133 – *GVRP configuration example*

GVRP Operations Notes

A dynamic VLAN must be converted to a static VLAN before it can have an IP address.

After converting a dynamic VLAN to a static VLAN use the **"save"** command to save the changes made – on a reboot the changes can be lost without the save command.

Within the same broadcast domain, a dynamic VLAN can pass through a device that is not GVRP-aware. This is because a hub or a switch that is not GVRP-aware will flood the GVRP (multicast) advertisement packets out all ports.

GVRP assigns dynamic VLANs as tagged VLANs. To configure the VLAN as untagged, first convert the tagged VLAN to a static VLAN.

Rebooting a switch with a dynamic VLAN deletes that VLAN. However, the dynamic VLAN re-appears after the reboot if GVRP is enabled and the switch again receives advertisements for that VLAN through a port configured to add dynamic VLANs.

By receiving advertisements from other devices running GVRP, the switch learns of static VLANs from those devices and dynamically (automatically) creates tagged VLANs on the links to the advertising devices. Similarly, the switch advertises its static VLANs to other GVRP-aware devices.

A GVRP-enabled switch does not advertise any GVRP-learned VLANs out of the port(s) on which it originally learned of those VLANs.

List of commands in this chapter

Syntax **show gvrp** *- shows whether GVRP is disabled, along with the current settings for the maximum number of VLANs and the current Primary VLAN*

Syntax **gvrp <enable|disable>** *- enable or disable GVRP*

Syntax **show-vlan** – *list all the VLANs (including dynamic VLANs) on the switch*

Syntax **set-ports port=<port|list|range> state=<learn|block|disable>** *- set the state of the port to learn, block or disable for GVRP. Note the default state is disable*

Syntax **static vlan=<VID>** *- convert a dynamic VLAN to a static VLAN*

Syntax **set-forbid vlan=<tag vlanid> forbid=<port-number|list|range>** *- sets the forbid GVRP capability on the ports specified*

Syntax **show-forbid** – *display the ports with GVRP forbid capabilities*

Chapter

20

20 – SNMP

Managing your network using SNMP

Simple Network Management Protocol (SNMP) enables management of the network. There are many software packages which provide a graphical interface and a graphical view of the network and its devices. The graphical interface and view would not be possible without SNMP. SNMP is thus the building block for network management.

SNMP concepts

SNMP provides the protocol to extract the necessary information from a networked device and display the information. The information is defined and stored in a Management Information Base (MIB). MIB is the "database" of the network management information.

SNMP has evolved over the years (since 1988) using the RFC process. Several RFC's today define the SNMP standards. The most common standards for SNMP are SNMP v1 (the original version of SNMP); SNMP v2 and more recently SNMP v3.

SNMP is a poll based mechanism. SNMP manager polls the managed device for information and display the information retrieved in text or graphical manner. Some definitions related to SNMP are

Community string – A text string used to authenticate messages between a management station and an SNMP v1/v2c engine

Simple Network Management Protocol (SNMP) – A network management protocol that provides a means to monitor and control network devices, and to manage configurations, statistics collection, performance, and security.

Simple Network Management Protocol Version 2c (SNMPv2c) – The second version of SNMP, it supports centralized and distributed network management strategies, and includes improvements in the Structure of Management Information (SMI), protocol operations, management architecture, and security

Simple Network Management Protocol Version 3 (SNMPv3) – The third version of SNMP, the enhancements made to secure access, different levels of access and security.

SNMP engine – A copy of SNMP that can either reside on the local or remote device

SNMP group – A collection of SNMP users that belong to a common SNMP list that defines an access policy, in which object identification numbers (OIDs) are both read-accessible and write-accessible. Users belonging to a particular SNMP group inherit all of these attributes defined by the group

SNMP user – A person for which an SNMP management operation is performed. The user is the person on a remote SNMP engine who receives the information

SNMP view – A mapping between SNMP objects and the access rights available for those objects. An object can have different access rights in each view. Access rights indicate whether the object is accessible by either a community string or a user

Write view – A view name (not to exceed 64 characters) for each group that defines the list of object identifiers (OIDs) that are able to be created or modified by users of the group

Authentication – The process of ensuring message integrity and protection against message replays. It includes both data integrity and data origin authentication

Authoritative SNMP engine – One of the SNMP copies involved in network communication designated to be the allowed SNMP engine which protects against message replay, delay, and redirection. The security keys used for authenticating and encrypting SNMPv3 packets are generated as a function of the authoritative SNMP engine's engine ID and user passwords. When an SNMP message expects a response (for example, get exact, get next, set request), the *receiver* of these messages is authoritative. When an SNMP message does not expect a response, the *sender* is authoritative

Data integrity – A condition or state of data in which a message packet has not been altered or destroyed in an unauthorized manner

Data origin authentication – The ability to verify the identity of a user on whose behalf the message is supposedly sent. This ability protects users against both message capture and replay by a different SNMP engine, and against packets received or sent to a particular user that use an incorrect password or security level

Encryption – A method of hiding data from an unauthorized user by scrambling the contents of an SNMP packet

Group – A set of users belonging to a particular security model. A group defines the access rights for all the users belonging to it. Access rights define what SNMP objects can be read, written to, or created. In addition, the group defines what notifications a user is allowed to receive

Notification host – An SNMP entity to which notifications (traps and informs) are to be sent

Notify view – A view name (not to exceed 64 characters) for each group that defines the list of notifications that can be sent to each user in the group

Privacy – An encrypted state of the contents of an SNMP packet where they are prevented from being disclosed on a network. Encryption is performed with an algorithm called CBC-DES (DES-56)

Read view – A view name (not to exceed 64 characters) for each group that defines the list of object identifiers (OIDs) that are accessible for reading by users belonging to the group

Security level – A type of security algorithm performed on each SNMP packet. The three levels are: noauth, auth, and priv. noauth authenticates a packet by a string match of the user name. auth authenticates a packet by using either the HMAC MD5 algorithms. priv authenticates a packet by using either the HMAC MD5 algorithms and encrypts the packet using the CBC-DES (DES-56) algorithm

Security model – The security strategy used by the SNMP agent. Currently, MNS-6K supports three security models: SNMPv1, SNMPv2c, and SNMPv3

Traps

The traps supported by MNS-6K are as follows:

SNMP Traps: Warm Start, Cold Start, Link Up, Link Down, Authentication Failure.
RMON Traps: Rising Alarm, Falling Alarm for RMON groups 1, 2, 3, and 9 (Statistics, Events, Alarms, and History)
Enterprise Traps: Intruder, S-Ring and LLL

Standards

There are several RFC's defining SNMP. MNS-6K supports the following RFC's and standards

SNMPv1 standards

- Security via configuration of SNMP communities
- Event reporting via SNMP
- Managing the switch with an SNMP network management tool Supported *Standard* MIBs include:
- SNMP MIB-II (RFC 1213)
- Bridge MIB (RFC 1493) (ifGeneralGroup, ifRcvAddressGroup, ifStackGroup)

- RMON MIB (RFC 1757)
- RMON: groups 1, 2, 3, and 9 (Statistics, Events, Alarms, and History)
- Version 1 traps (Warm Start, Cold Start, Link Up, Link Down, Authentication Failure, Rising Alarm, Falling Alarm)

RFC 1901-1908 – SNMPv2

- RFC 1901, Introduction to Community-Based SNMPv2. SNMPv2 Working Group
- RFC 1902, Structure of Management Information for Version 2 of the Simple Network Management Protocol (SNMPv2). SNMPv2 Working Group
- RFC 1903, Textual Conventions for Version 2 of the Simple Network Management Protocol (SNMPv2). SNMPv2 Working Group
- RFC 1904, Conformance Statements for Version 2 of the Simple Network Management Protocol (SNMPv2). SNMPv2 Working Group
- RFC 1905, Protocol Operations for Version 2 of the Simple Network Management Protocol (SNMPv2). SNMPv2 Working Group
- RFC 1906, Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMPv2)
- RFC 1907, Management Information Base for Version 2 of the Simple Network Management Protocol (SNMPv2). SNMPv2 Working Group
- RFC 1908, Coexistence between Version 1 and Version 2 of the Internet-standard Network Management Framework. SNMPv2 Working Group

RFC 2271-2275 – SNMPv3

- RFC 2104, Keyed Hashing for Message Authentication
- RFC 2271, An Architecture for Describing SNMP Management Frameworks
- RFC 2272, Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
- RFC 2273, SNMPv3 Applications
- RFC 2274, User-Based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)
- RFC 2275, View-Based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)

Configuring SNMP

There are several commands and variable which can be set for configuring SNMP. They are listed below. The basic SNMP v1 parameters can be set by referring to the section on System Parameters. Most commands here refer to SNMP v3 commands and how the variables for SNMP v3 can be configured.

Syntax **snmp** – *enter the SNMP Configuration mode*

Syntax **set snmp type=<v1|all>** - *define the version of SNMP to use – the option all supports all versions (v1, v2 and v3) – v1 restricts SNMP to v1 only. By default – SNMP v1only is enabled*

Syntax **show active-snmp** – *shows the version of SNMP currently in use*

Syntax **community [write=<write community>] [read=<read community>] [trap=<trap community>]** – *set the necessary community strings*

Syntax **authtraps <enable|disable>** *- enables or disables authentication traps generation*

Syntax **traps <add|delete> type=<Snmp|Rmon|Snmp,Rmon|Enterprise|Snmp,Enterprise |Rmon,Enterprise|All> ip=<ipaddress>** *- add v1 traps as well as define the trap receiver*

Syntax **show snmp** – *displays the SNMP configuration information*

Syntax **mgrip <add|delete> ip=<IPaddress>** *- adds or deletes a management station, specified by the IP address, which can query SNMP variables from the switch. This is done to protect the switch from being polled by unauthorized managers. Valid for SNMP v1. Maximum of 5 stations allowed*

Syntax **setvar [sysname|syscontact|syslocation]=<string>** *sets the system name, contact and location. All parameters are optional but a user must supply at least one parameter*

Syntax **snmpv3** – *enter the SNMP V3 configuration mode – note enable SNMP V3 by using the* ***"set snmp"*** *command which follows*

Syntax **quickcfg** *- quick setup for snmpv3 configuration. It automatically configures a default VACM (view-based access control model). This allows any manager station to access the Magnum 6K switch either via SNMP v1, v2c or v3. The community name is "public". This command is only intended for first time users and values can be changed by administrators who want more strict access*

Syntax **engineid string=<string>** *- Every agent has to have an engineID (name) to be able to respond to SNMPv3 messages. The default engine ID value is "6K_v3Engine". This command allows the user to change the engine ID*

Syntax **show-authtrap** *- displays the current value of authentication trap status.*

Syntax **deftrap community=<string>** *- defines the default community string to be used when sending traps. When user does not specify the trap community name when setting a trap station using the "trap" command, the default trap community name is used*

Syntax **show-deftrap** *- displays the current value of default trap*

Syntax **trap <add|delete> id=<id> [type=<v1|v2|inform>] [host=<host-ip>] [community=<string>] [port=<1-65534>] -** *define the trap and inform manager stations. The station can receive v1, v2 traps and/or inform notifications. An inform notification is an acknowledgments that a trap has been received. A user can add up to 5 stations.*

Syntax **show-trap [id=<id#>]***- shows the configured trap stations in tabular format - id is optional and is the number corresponding to the trap entry number in the table*

Syntax **com2sec <add|delete> id=<id> [secname=<name>] [source=<source>] [community=<community>]** *- a part of the View based Access control model (VACM) as defined in RFC 2275. This specifies the mapping from a source/community pair to a security name. On MNS-6K, up to 10 entries can be specified*

Syntax **group <add|delete> id=<id> [groupname=<name>] [model=<v1|v2c|usm>] [com2secid=<com2sec-id>]** *- a part of the View based Access control model (VACM) as defined in RFC 2275. This command defines the mapping from sec model or a sec name to a group. A sec model is one of v1, v2c, or usm. On MNS-6K, up to 10 entries can be specified*

Syntax **show-group [id=<id>]** *- display all or specific group entries - id is optional and is the number corresponding to the group entry number in the table*

Syntax **view <add|delete> id=<id> [viewname=<name>] [type=<included|excluded>] [subtree=<oid>] [mask=<hex-string>]** *- a part of the View based Access control model (VACM) as defined in RFC 2275. This command defines a manager or group or manager stations what it can access inside the MIB object tree. On MNS-6K, up to 10 entries can be specified*

Syntax **show-view [id=<id>]** *- display all or specific view entries - id is optional and is the number corresponding to the view entry number in the table*

Syntax **user <add|delete> id=<id> [username=<name>] [usertype=<readonly|readwrite>] [authpass=<pass-phrase>] [privpass=<pass-phrase>] [level=<noauth|auth|priv>] [subtree=<oid>]** *for quickly adding or deleting v3 USM based security, this command adds user entries. MNS-6K allows up to 5 users to be added. Right now, the MNS-6K agent only support noauth and auth-md5 for v3 authentication and auth-des for priv authentication*

Syntax **show-user [id=<id>]** *- display all or specific view entries - id is optional and is the number corresponding to the view entry number in the table*

```
Magnum6K25# set snmp type=v1

Magnum6K25# show active-snmp

 6K SNMP Agent supports v1 only.

Magnum6K25# show snmp

  SNMP CONFIGURATION INFORMATION
  ------------------------------
  SNMP Get Community Name       : public
  SNMP Set Community Name       : private
  SNMP Trap Community Name      : public
  AuthenTrapsEnableFlag         : disabled
  SNMP Access Status            : enabled
```

```
  SNMP MANAGERS INFO
  ------------------

  SNMP TRAP STATIONS INFO
  -----------------------

Magnum6K25# snmp

Magnum6K25(snmp)## community write=private read=public

  SNMP Read community name successfully set

  SNMP Write community name successfully set

Magnum6K25(snmp)## show snmp

  SNMP CONFIGURATION INFORMATION
  ------------------------------
  SNMP Get Community Name  :  public
  SNMP Set Community Name  :  private
  SNMP Trap Community Name :  public
  AuthenTrapsEnableFlag    :  enabled
  SNMP Access Status       :  enabled

  SNMP MANAGERS INFO
  ------------------

  SNMP TRAP STATIONS INFO
  -----------------------

Magnum6K25(snmp)## mgrip add ip=192.168.1.111

  Manager IP Address added successfully

Magnum6K25(snmp)## mgrip add ip=192.168.1.222

  Manager IP Address added successfully

Magnum6K25(snmp)# show snmp

  SNMP CONFIGURATION INFORMATION
  ------------------------------
  SNMP Get Community Name  :  public
  SNMP Set Community Name  :  private
  SNMP Trap Community Name :  public
  AuthenTrapsEnableFlag    :  disabled
  SNMP Access Status       :  enabled

  SNMP MANAGERS INFO
  ------------------
  IP Address = 192.168.1.111
  IP Address = 192.168.1.222
```

Use this command for SNMP v1 managers. Without this command SNMP v1 managers will not be able to manage the switches. Not needed for SNMP v3. Note – maximum of 5 stations allowed.

Managers added are displayed under the SNMP information by using the "show snmp" command

```
 SNMP TRAP STATIONS INFO
 ----------------------

Magnum6K25(snmp)## traps add type=Snmp,Rmon ip=192.168.1.2

 Successfully Added.

Magnum6K25(snmp)## show snmp

 SNMP CONFIGURATION INFORMATION
 ------------------------------
 SNMP Get Community Name  :  public
 SNMP Set Community Name  :  private
 SNMP Trap Community Name :  public
 AuthenTrapsEnableFlag    :  enabled
 SNMP Access Status       :  enabled

 SNMP MANAGERS INFO
 ------------------
 IP Address = 192.168.1.111
 IP Address = 192.168.1.222

 SNMP TRAP STATIONS INFO
 ----------------------
 IP Address = 192.168.1.2 Trap Type = SNMP,RMON


Magnum6K25(snmp)# exit

Magnum6K25# show snmp

 SNMP CONFIGURATION INFORMATION
 ------------------------------
 SNMP Get Community Name  :  public
 SNMP Set Community Name  :  private
 SNMP Trap Community Name :  public
 AuthenTrapsEnableFlag    :  enabled
 SNMP Access Status       :  enabled

 SNMP MANAGERS INFO
 ------------------
 IP Address = 192.168.1.111
 IP Address = 192.168.1.222

 SNMP TRAP STATIONS INFO
 ----------------------
 IP Address = 192.168.1.2 Trap Type = SNMP,Enterprise

Magnum6K25# set snmp type=all

 SNMP version support is set to "v1, v2c and v3"

Magnum6K25# show active-snmp
```

Managers added are displayed under the SNMP information by using the "show snmp" command

6K SNMP Agent supports all (v1/v2c/v3) versions.

Magnum6K25# show snmp

SNMP v3 Configuration Information
==========

System Name	: Magnum6K25
System Location	: Fremont, CA
System Contact	: support@garrettcom.com
Authentication Trap	: Disabled
Default Trap Comm.	: public
V3 Engine ID	: 6K_v3Engine

Magnum6K25# snmpv3

Switch over to SNMPv3 from this point forward

Magnum6K25(snmpv3)## setvar sysname=my_m6k syscontact=admin syslocation=lab

Magnum6K25(snmpv3)# quickcfg

This will enable default VACM.

Do you wish to proceed? ['Y' or 'N'] **Y**
Quick configuration done, default VACM enabled

Max limit of system variables is 15 characters

Magnum6K25(snmpv3)## engineid string=Magnum6K

Engine ID is set successfully

Magnum6K25(snmpv3)## authtrap enable

Authentication trap status is set successfully

Magnum6K25(snmpv3)## show-authtrap

Authentication Trap Status: Enabled

Magnum6K25(snmpv3)## deftrap community=mysecret

Default trap community is set successfully

Magnum6K25(snmpv3)## show-deftrap

Default Trap Community : public

Magnum6K25(snmpv3)## trap add id=1 type=v1 host=10.21.1.100

Entry is added successfully

```
Magnum6K25(snmpv3)## show-trap

 ID   Trap Type          Host IP          Community   Port
 ================================================================
 1     v1                10.21.1.100      --          --
 2     --                --               --          --
 3     --                --               --          --
 4     --                --               --          --
 5     --                --               --          --

Magnum6K25(snmpv3)## show-trap id=1

 Trap ID        : 1
 Trap Type      : v1
 Host IP        : 10.21.1.100
 Community      : --
 Auth. Type     : --

Magnum6K25(snmpv3)## com2sec add id=1 secname=public source=default community=public

 Entry is added successfully

Magnum6K25(snmpv3)## com2sec add id=2

 ERROR: "secname" parameter is required for "add" directive

Magnum6K25(snmpv3)## com2sec add id=2 secname=BCM

 Entry is added successfully

Magnum6K25(snmpv3)## show-com2sec

 ID Sec. Name      Source         Community
 ================================================
 1     public       default        public
 2     BCM          default        public
 3     --           --             --
 4     --           --             --
 5     --           --             --
 6     --           --             --
 7     --           --             --
 8     --           --             --
 9     --           --             --
10     --           --             --

Magnum6K25(snmpv3)## show-com2sec id=2

 Com2Sec ID     : 2
 Security Name  : BCM
 Source         : default
 Community      : public
```

```
Magnum6K25(snmpv3)## group add id=1 groupname=v1 model=v1 com2secid=1

 Entry is added successfully

Magnum6K25(snmpv3)## show-group

 ID     Group Name     Sec. Model     Com2Sec ID
 ================================================
 1          v1             v1             1
 2          public         v2c            1
 3          public         usm            1
 4          --             --             --
 5          --             --             --
 6          --             --             --
 7          --             --             --
 8          --             --             --
 9          --             --             --
10          --             --             --

Magnum6K25(snmpv3)## show-group id=1

 Group ID      : 1
 Group Name : v1
 Model         : v1
 Com2Sec ID  : 1

Magnum6K25(snmpv3)## view add id=1 viewname=all type=included subtree=.1

 Entry is added successfully

Magnum6K25(snmpv3)## show-view

 ID View Name      Type      Subtree            Mask
 ========================================
 1      all          included      .1             ff
 2      --           --            --             --
 3      --           --             --            --
 4      --           --            --             --
 5      --           --            --             --
 6      --           --            --             --
 7      --           --            --             --
 8      --           --            --             --
 9      --           --            --             --
10      --           --            --             --

Magnum6K25(snmpv3)## show-view id=1

 View ID        : 1
 View Name    : all
 Type           : included
 Subtree        : .1
 Mask           : ff
```

```
Magnum6K25(snmpv3)## access add id=1 accessname=v1 model=v1 level=noauth read=1 writ
e=none notify=none

 Entry is added successfully

Magnum6K25(snmpv3)## show-access

 ID  View Name  Model    Level   R/View  W/View  N/View  Context     Prefix
 ============================================================
 1       v1         v1      noauth  1       none    none    ""          exact
 2       --         --      --      --      --      --      --          --
 3       --         --      --      --      --      --      --          --
 4       --         --      --      --      --      --      --          --
 5       --         --      --      --      --      --      --          --
 6       --         --      --      --      --      --      --          --
 7       --         --      --      --      --      --      --          --
 8       --         --      --      --      --      --      --          --
 9       --         --      --      --      --      --      --          --
 10      --         --      --      --      --      --      --          --

Magnum6K25(snmpv3)## show-access id=1

 Access ID       : 1
 Access Name     : v1
 Sec. Model      : v1
 Sec. Level      : noauth
 Read View ID    : 1
 Write View ID   : none
 Notify View ID  : none
 Context         : ""
 Prefix          : exact

Magnum6K25(snmpv3)## user add id=1 username=jsmith usertype=readwrite
authpass=something

 Entry is added successfully

Magnum6K25(snmpv3)## show-user

 ID User Name    UType    AuthPass    PrivPass    AType   Level   Subtree
 ================================================================
 1    jsmith       RW     something             MD5     auth
 2    --           --     --          --        --      --      --
 3    --           --     --          --        --      --      --
 4    --           --     --          --        --      --      --
 5    --           --     --          --        --      --      --

Magnum6K25(snmpv3)## show-user id=2

 ERROR: Entry is not active
```

```
Magnum6K25(snmpv3)## show-user id=1

 User ID        : 1
 User Name      : jsmith
 User Type      : read-write
 Auth. Pass      something
 Priv. Pass     :
 Auth. Type     : MD5
 Auth. Level    : auth
 Subtree        :

 Magnum6K25(snmpv3)## exit

 Magnum6K25# show snmp

 SNMPv3 Configuration Information
 ================================

   System Name          : Magnum6K25
   System Location      : Fremont, CA
   System Contact       : support@garrettcom.com
   Authentication Trap  : Enabled
   Default Trap Comm.   : public
   V3 Engine ID         : 6K_v3Engine

 Magnum6K25#
```

FIGURE 134 – *Configuring SNMP – most of the command here are SNMP v3 commands*

Configuring RMON

The switch supports RMON (Remote Monitoring) on all connected network segments. This allows for troubleshooting and optimizing your network. The Magnum 6K family of switches provides hardware-based RMON counters. The switch manager or a network management system can poll these counters periodically to collect the statistics in a format that complies with the RMON MIB definition.

The following RMON groups are supported:

- Ethernet Statistics Group - maintains utilization and error statistics for the switch port being monitored.
- History Group – gathers and stores periodic statistical samples from previous Statistics Group.
- Alarm Group – allows a network administrator to define alarm thresholds for any MIB variable.
- Log and Event Group – allows a network administrator to define actions based on alarms. SNMP Traps are generated when RMON Alarms are triggered.

The following RMON communities, when defined, enable the specific RMON group as show above.

Syntax **rmon** – *enter the RMON configuration mode to setup RMON groups and communities*

Syntax **history def-owner=<string> def-comm=<string>** *- define the RMON history group and the community string associated with the group*

Syntax **statistics def-owner=<string> def-comm=<string>***- define the RMON statistics group and the community string associated with the group*

Syntax **alarm def-owner=<string> def-comm=<string>** *- define the RMON alarm group and the community string associated with the group*

Syntax **event def-owner=<string> def-comm=<string>** *- define the RMON event group and the community string associated with the group*

Syntax **show rmon <stats|hist|event|alarm>** *- list the specific RMON data as defined by the group type*

```
Magnum6K25# rmon

Magnum6K25(rmon)## event def-owner=test def-comm=somestring

 RMON Event Default Owner is set
 RMON Event Default Community is set

Magnum6K25(rmon)## show rmon event

 RMON Event Default Owner      : test
 RMON Event Default Community  : somestring

Magnum6K25(rmon)## exit

Magnum6K25#
```

FIGURE 135 – *Configuring RMON groups*

List of commands in this chapter

Syntax **snmp** – *enter the SNMP Configuration mode*

Syntax **snmpv3** – *enter the SNMP V3 configuration mode – note enable SNMP V3 by using the* ***"set snmp"*** *command which follows*

Syntax **show active-snmp** – *shows the version of SNMP currently in use*

Syntax **community [write=<write community>] [read=<read community>] [trap=<trap community>]** – *set the necessary community strings*

Syntax **authtraps <enable|disable>** *- enables or disables authentication traps generation*

Syntax **traps <add|delete> type=<Snmp|Rmon|Snmp,Rmon|Enterprise|Snmp,Enterprise |Rmon,Enterprise|All> ip=<ipaddress>** *- add v1 traps as well as define the trap receiver*

Syntax **mgrip <add|delete> ip=<IPaddress>** *- adds or deletes a management station, specified by the IP address, which can query SNMP variables from the switch. This is done to protect the switch from being polled by unauthorized managers. Valid for SNMP v. Maximum of five stations allowed.*

Syntax **set snmp type=<v1|all>** *- define the version of SNMP to use – the option all supports all versions (v1, v2 and v3) – v1 restricts SNMP to v1 only. By default – SNMP v1only is enabled*

Syntax **show snmp** – *displays the SNMP configuration information*

Syntax **setvar [sysname|syscontact|syslocation]=<string>** *sets the system name, contact and location. All parameters are optional but a user must supply at least one parameter*

Syntax **quickcfg** *- quick setup for snmpv3 configuration. It automatically configures a default VACM (view-based access control model). This allows any manager station to access the Magnum 6K switch either via SNMP v1, v2c or v3. The community name is "public". This command is only intended for first time users and values can be changed by administrators who want more strict access*

Syntax **engineid string**=**<string>** *- Every agent has to have an engineID (name) to be able to respond to SNMPv3 messages. The default engine ID value is "6K_v3Engine". This command allows the user to change the engine ID*

Syntax **authtrap <enable|disable>** *- enables or disables authentication traps generation*

Syntax **show-authtrap** *- displays the current value of authentication trap status.*

Syntax **deftrap community**=<string> *- defines the default community string to be used when sending traps. When user does not specify the trap community name when setting a trap station using the "trap" command, the default trap community name is used*

Syntax **show-deftrap** *- displays the current value of default trap*

Syntax **trap <add|delete> id=<id> [type=<v1|v2|inform>] [host=<host-ip>] [community=<string>] [port=<1-65534>] -** *define the trap and inform manager stations. The station can receive v1, v2 traps and/or inform notifications. An inform notification is an acknowledgments that a trap has been received. A user can add up to 5 stations.*

Syntax **show-trap [id=<id#>]**- *shows the configured trap stations in tabular format - id is optional and is the number corresponding to the trap entry number in the table*

Syntax **com2sec <add|delete> id=<id> [secname=<name>] [source=<source>] [community=<community>]** *- a part of the View based Access control model (VACM) as defined in RFC 2275. This specifies the mapping from a source/community pair to a security name. On MNS-6K, up to 10 entries can be specified*

Syntax **group <add|delete> id=<id> [groupname=<name>] [model=<v1|v2c|usm>] [com2secid=<com2sec-id>]** *- a part of the View based Access control model (VACM) as defined in RFC 2275. This command defines the mapping from sec model or a sec name to a group. A sec model is one of v1, v2c, or usm. On MNS-6K, up to 10 entries can be specified*

Syntax **show-group [id=<id>]** *- display all or specific group entries - id is optional and is the number corresponding to the group entry number in the table*

Syntax **view <add|delete> id=<id> [viewname=<name>] [type=<included|excluded>] [subtree=<oid>] [mask=<hex-string>]** *- a part of the View based Access control model (VACM) as defined in RFC 2275. This command defines a manager or group or manager stations what it can access inside the MIB object tree. On MNS-6K, up to 10 entries can be specified*

Syntax **show-view [id=<id>]** *- display all or specific view entries - id is optional and is the number corresponding to the view entry number in the table*

Syntax **user <add|delete> id=<id> [username=<name>] [usertype=<readonly|readwrite>] [authpass=<pass-phrase>] [privpass=<pass-phrase>] [level=<noauth|auth|priv>] [subtree=<oid>]** *for quickly adding or deleting v3 USM based security, this command adds user entries. MNS-6K allows up to 5 users to be added. Right now, the MNS-6K agent only support noauth and auth-md5 for v3 authentication and auth-des for priv authentication*

Syntax **show-user [id=<id>]** *- display all or specific view entries - id is optional and is the number corresponding to the view entry number in the table*

Syntax **rmon** – *enter the RMON configuration mode to setup RMON groups and communities*

Syntax **history def-owner=<string> def-comm=<string>** *- define the RMON history group and the community string associated with the group*

Syntax **statistics def-owner=<string> def-comm=<string>***- define the RMON statistics group and the community string associated with the group*

Syntax **alarm def-owner=<string> def-comm=<string>** *- define the RMON alarm group and the community string associated with the group*

Syntax **event def-owner=<string> def-comm=<string>** *- define the RMON event group and the community string associated with the group*

Syntax **show rmon <stats|hist|event|alarm>** *- list the specific RMON data as defined by the group type*

Chapter

21

21 – Miscellaneous Commands

Improving productivity and manageability

There are several features built into the Magnum 6K family of switches which help with the overall productivity and manageability of the switch. These items are examined individually in this chapter.

Alarm Relays

In a wiring closet, it would be helpful if there was a visual indication for faults on components on the network. Normally, these would be performed by LED's. While the Magnum 6K family of switches has the necessary LED's to provide the information needed, it also has a provision for tripping or activating an external relay to electrically trigger any circuit desired. These could be an indicator light, a flashing strobe light, an audible alarm or any other such devices.

The Magnum 6K family of switches has a software (optional) controlled relay contact that can be use to report alarm conditions. The relay is held closed (connection) in normal circumstances and will go to open position during alarm conditions.

Two types of alarm signals are defined in the alarm system.

- SUSTAINED
- MOMENTARY

The SUSTAINED mode is used to report a continuing error condition. The MOMENTARY mode is used to report a single event.

The following pre-defined events are currently supported on the MNS-6K and the relay which can be triggered by software:

Event ID	Event Description	Signal Type
1	S-RING OPEN	SUSTAINED
2	Cold Start	MOMENTARY
3	Warm Start	MOMENTARY
4	Link Up	MOMENTARY
5	Link Down	MOMENTARY
6	Authentication Failure	MOMENTARY
7	RMON Rising Alarm[9]	MOMENTARY
8	RMON Falling Alarm	MOMENTARY
9	Intruder Alarm	MOMENTARY
10	Link Loss Learn Triggered	MOMENTARY
11	Broadcast Storm Detected	MOMENTARY
12	STP/RSTP Reconfigured	MOMENTARY

FIGURE 136 – *Predefined conditions for the relay*

The S-RING open condition generates a sustained relay contact close. The relay will stay closed during the period which the S-RING is in OPEN condition. The relay will revert to closed position when the S-RING goes to CLOSED position. This information is covered in more details in Chapter 11 on S-Ring and Link-Loss-Learn.

To customize these capabilities, the MNS-6K provides additional software capabilities and commands for configuring the behavior. They are

Syntax **alarm** – *enter the alarm configuration mode*

Syntax **add event=<event-id|list|range|all>** *- enables alarm action in response to the specified event ID*

[9] The RMON settings are when the RMON thresholds are crossed and hence indicated as RMON rising or falling – indicating the threshold has been crossed . While there is no specific command to view and change the specific RMON variables, the RMON discussion is in Chapter 16. Best way to set RMON values will be via using the web interface or a Management system such as Castle Rock's SNMPc™

Syntax **period time=<1..10>** *- sets the duration of relay action for the momentary type signal. This may be needed to adjust to the behavior of the circuit or relay. Default is 3 seconds. Time is in seconds*

Syntax **del event=<event-id|list|range|all>** *- disables alarm action in response to the specified event ID*

Syntax **alarm <enable|disable>** *- globally enables or disables the alarm action*

Syntax **show alarm** *- displays the current status of Alarm system*

```
Magnum6K25# alarm

Magnum6K25(alarm)## add event=2
Alarm Event(s) Added: 2

Magnum6K25(alarm)## add event=1-5
Event 2 is Already Enabled.
Alarm Event(s) Added: 1, 3, 4, 5

Magnum6K25(alarm)## add event=6,8
Alarm Event(s) Added: 6, 8

Magnum6K25(alarm)## add event=all
Event 1 is Already Enabled.
Event 2 is Already Enabled.
Event 3 is Already Enabled.
Event 4 is Already Enabled.
Event 5 is Already Enabled.
Event 6 is Already Enabled.
Event 8 is Already Enabled.
Alarm Event(s) Added: 7, 9, 10, 11, 12

Magnum6K25(alarm)## del event=2
Alarm Event(s) Deleted: 2

Magnum6K25(alarm)## period time=5
Relay closure Time Set.

Magnum6K25(alarm)## show alarm
Alarm Events Configuration
--------------------------

 Alarm Status: DISABLED
 Relay Closure Time Period: 5 Seconds

      EventId Description                Mode

    1 S-RING OPEN                        SUSTAINED
    2 Cold Start                         NOT ENABLED
    3 Warm Start                         MOMENTARY
    4 Link Up                            MOMENTARY
    5 Link Down                          MOMENTARY
```

```
   6  Authentication Failure          MOMENTARY
   7  RMON Raising Alarm              MOMENTARY
   8  RMON Falling Alarm              MOMENTARY
   9  Intruder Alarm                  MOMENTARY
  10  Link Loss Learn Triggered       MOMENTARY
  11  Broadcast Storm Detected        MOMENTARY
  12  STP/RSTP Reconfigured           MOMENTARY

Magnum6K25(alarm)## add event=2
Alarm Event(s) Added: 2

Magnum6K25(alarm)## show alarm
Alarm Events Configuration
--------------------------

 Alarm Status: DISABLED
 Relay Closure Time Period: 5 Seconds

      EventId Description             Mode

   1  S-RING OPEN                     SUSTAINED
   2  Cold Start                      MOMENTARY
   3  Warm Start                      MOMENTARY
   4  Link Up                         MOMENTARY
   5  Link Down                       MOMENTARY
   6  Authentication Failure          MOMENTARY
   7  RMON Raising Alarm              MOMENTARY
   8  RMON Falling Alarm              MOMENTARY
   9  Intruder Alarm                  MOMENTARY
  10  Link Loss Learn Triggered       MOMENTARY
  11  Broadcast Storm Detected        MOMENTARY
  12  STP/RSTP Reconfigured           MOMENTARY

Magnum6K25(alarm)## alarm enable
Alarm system Enabled

Magnum6K25(alarm)## show alarm
Alarm Events Configuration
--------------------------

 Alarm Status: ENABLED
 Relay Closure Time Period: 5 Seconds

      EventId Description             Mode

   1  S-RING OPEN                     SUSTAINED
   2  Cold Start                      MOMENTARY
   3  Warm Start                      MOMENTARY
   4  Link Up                         MOMENTARY
   5  Link Down                       MOMENTARY
   6  Authentication Failure          MOMENTARY
   7  RMON Raising Alarm              MOMENTARY
   8  RMON Falling Alarm              MOMENTARY
```

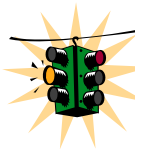
```
  9  Intruder Alarm                    MOMENTARY
 10  Link Loss Learn Triggered         MOMENTARY
 11  Broadcast Storm Detected          MOMENTARY
 12  STP/RSTP Reconfigured             MOMENTARY

Magnum6K25(alarm)## alarm disable
Alarm system Disabled


Magnum6K25(alarm)## del event=1,3,5,7
Alarm Event(s) Deleted: 1, 3, 5, 7

Magnum6K25(alarm)## show alarm
Alarm Events Configuration
--------------------------

 Alarm Status: DISABLED
 Relay Closure Time Period: 5 Seconds

      EventId Description               Mode

  1  S-RING OPEN                       NOT ENABLED
  2  Cold Start                        MOMENTARY
  3  Warm Start                        NOT ENABLED
  4  Link Up                           MOMENTARY
  5  Link Down                         NOT ENABLED
  6  Authentication Failure            MOMENTARY
  7  RMON Raising Alarm                NOT ENABLED
  8  RMON Falling Alarm                MOMENTARY
  9  Intruder Alarm                    MOMENTARY
 10  Link Loss Learn Triggered         MOMENTARY
 11  Broadcast Storm Detected          MOMENTARY
 12  STP/RSTP Reconfigured             MOMENTARY

Magnum6K25(alarm)## exit

Magnum6K25#
```

FIGURE 137 – *Setting up the external electrical relay and alerts*

Email

SMTP (RFC 821) is a TCP/IP protocol used in sending email. However, since it is limited in its ability to queue messages at the receiving end, it's usually used with one of two other protocols, POP3 or Internet Message Access Protocol (IMAP) that lets the user save messages in a server mailbox and download them as needed from the server. In other words, users typically use a program that uses SMTP for sending emails (out going – e.g. replying to an email message) and either POP3 or IMAP for receiving messages that have been arrived from the outside world. While SMTP (and its related protocols such as POP3, IMAP etc.) are useful transports for

sending and receiving emails, it is extremely beneficial for a network administrator to receive emails in case of faults and alerts. The Magnum 6K family of switches can be setup to send an email alert when a trap is generated.



If this capability is used, please ensure that SPAM filters and other filters are not set to delete these emails.

GarrettCom Inc. recommends that a rule be setup on the mail server so that all emails indicating SNMP faults are automatically stored in a folder or redirected to the necessary administrators.

The SNMP alerts can be configured using MNS-6K for the following:

- Send email alert according to the configuration rules when a specific event category happens
- Send email alert according to the configuration rules when a specific trap SNMP trap category happens
- Provide configuration and customization commands for users to specify SMTP server to connect to, TCP ports, user recipients and filters

The SMTP alerts provide the following capabilities:

- SMTP alerts can be enabled or disabled globally
- User can define a global default SMTP server identified by its IP address, TCP port and retry count
- User can add up to five SMTP alert recipients. Each recipient is identified by an ID and email address. The email address needs to be a valid address and can be an alias setup for distribution to a larger audience
- Filters are provided for each recipient to allow only certain categories of traps and events be sent by email
- Each recipient can have its own SMTP server and TCP port number, if this is not defined on a certain recipient, the default SMTP server and TCP port number is used

Syntax **smtp** – *configure the SNMP alerts to be sent via email*

Syntax **show smtp <config|recipients>** - ***config*** – *displays the current SMTP global settings and* ***recipients*** *displays the currently configured recipients of email alerts*

Syntax **add id=<1-5> email=<email-addr> [traps=<all|none|S|R|E>] [events=<all|none|I|A|C|F|D>] [ip=<ip-addr>] [port=<1-65535>]**

id – [mandatory] the recipient ID - range from 1 to 5. MNS-6K allows a maximum of 5 recipients

email – [mandatory] email address of the recipient

traps – [optional] this is the trap filter. If value is "all", all traps of any type will be sent to this recipient. If value is none, no traps are sent to this recipient. Value can also be a combination of 'S' (SNMP), 'R' (RMON) and 'E' (ENTERPRISE). For example, trap=SR means that SNMP and RMON traps will be sent via email to the recipient. If this option is not defined, the recipient will have a default value of "all"

events – [optional] this is the event filter. Value can be "all" - all event severity types will be sent to recipient, "none" - no event will be sent to recipient or a combination of 'I' (informational), 'A' (activity), 'C' (critical), 'F' (fatal) and 'D' (debug). With **"event=ACF"** implies that events of severity types activity, critical and fatal will be sent to recipients by email. If this option is not defined, a value of "all" is taken

ip – [optional] SMTP server IP address. This is the SMTP server to connect to for this particular user. If this option is not defined, the global/default SMTP server is used

port – [optional] TCP port of the SMTP server. If this is not defined, the global default TCP port is used

Syntax **delete id=<1-5> -** *delete the specific id specified. The deleted id no longer receives the traps via email. The id is added using the "add" command*

Syntax **sendmail server=<ip-addr> to=<email-addr> from=<email-addr> subject=<string> body=<string>** *- customize (and also to send a test email to check SMTP settings) the email sent out by specifying the email subject field, server address, to field and the body of the text. See example fo the body of the text message later in this chapter*

server – [mandatory] SMTP server IP v4 address.

to – [mandatory] the recipient email address

from – [mandatory] the sender email address.

subject – [mandatory] email subject or title

body – [mandatory] email body

Syntax **server ip=<ip-addr> [port=<1-65535>] [retry=<0-3>]** – *configure the global SMTP server settings*

ip – [mandatory] SMTP server IP address

port – [mandatory] TCP port to be used for SMTP communications – default is 25

retry – [optional] specifies how many times to retry if an error occurs when sending email. Range from 0 to 3. Default is 0.

Syntax **smtp <enable|disable>** *- enables or disables SMTP to send SNMP alerts by email*

```
Magnum6K25# smtp

Magnum6K25(smtp)## show smtp config

      SMTP Global Configuration
 ======================================
 Status                  : Disabled
 SMTP Server IP          : 67.109.247.195
 SMTP Server Port        : 25
 Retry Count             : 3

Magnum6K25(smtp)## show smtp recipients

 ID      E-mail Address          SMTP Server      Port     Traps    Events
=============================================================
 1       rk@gci,sys@gci.com      67.109.247.195   25       All      All
 2       --                      --               --       --       --
 3       --                      --               --       --       --
 4       --                      --               --       --       --
 5       --                      --               --       --       --

Magnum6K25(smtp)## add id=2 email=jsmith@garrettcom.com traps=S events=CF

Recipient successfully added

Magnum6K25(smtp)## show smtp recipients

 ID      E-mail Address          SMTP Server      Port     Traps    Events
=============================================================
 1       rk@gci,sys@gci.com      67.109.247.195   25       All      All
 2       jsmith@gci.com          67.109.247.195   25       S        CF
 3       --                      --               --       --       --
 4       --                      --               --       --       --
 5       --                      --               --       --       --

Magnum6K25(smtp)## delete id=2

Recipient successfully deleted

Magnum6K25(smtp)## show smtp recipients

 ID      E-mail Address          SMTP Server      Port     Traps    Events
=============================================================
 1       rk@gci,sys@gci.com      67.109.247.195   25       All      All
 2       --                      --               --       --       --
 3       --                      --               --       --       --
 4       --                      --               --       --       --
 5       --                      --               --       --       --
```

Note – there are two recipients – multiple recipients can be added – they have to be comma separated and there should be no spaces between each name.

Jsmith will only receive Critical or Fatal SNMP traps

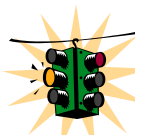
```
Magnum6K25(smtp)## add id=2 email=jsmith@garrettcom.com traps=S events=CF
ip=192.168.10.13

Recipient successfully added

Magnum6K25(smtp)## show smtp recipients

 ID        E-mail Address          SMTP Server       Port      Traps     Events
==========================================================
 1         rk@gci,sys@gci.com      67.109.247.195    25        All       All
 2         jsmith@gci.com          192.168.10.13     25        S         CF
 3         --                      --                --        --        --
 4         --                      --                --        --        --
 5         --                      --                --        --        --

Magnum6K25(smtp)## sendmail server=10.21.1.2 to=jack@garrettcom.com
from=support@garrettcom.com subject=test body=hello

Magnum6K25(smtp)## smtp enable

  SMTP Alert is enabled.

Magnum6K25(smtp)## sendmail server=10.21.1.2 to=jack@garrettcom.com
from=support@garrettcom.com subject=test body=hello


Magnum6K25(smtp)## show smtp config

      SMTP Global Configuration
 ======================================
 Status                 : Enabled
 SMTP Server IP         : 67.109.247.195
 SMTP Server Port       : 25
 Retry Count            : 3


Magnum6K25(smtp)## smtp disable

  SMTP Alert is disabled.

Magnum6K25(smtp)## show smtp config

      SMTP Global Configuration
 ======================================
 Status                 : Disabled
 SMTP Server IP         : 67.109.247.195
 SMTP Server Port       : 25
 Retry Count            : 3

Magnum6K25(smtp)## exit
```

Jsmith will receive Critical and Fatal SNMP traps on a different SMTP server than the other users. You may want to do that if you expect a higher traffic load and don't want to throttle a SMTP server

A test email is sent to Jack to test email connectivity. This email will not work as SMTP was disabled. The sendmail command after SMTP is enabled will work.

```
Magnum6K25#
```

FIGURE 138 – *setting SMTP to receive SNMP trap information via email*



Email alerts can be forwarded to be received by other devices such as Cell phones, pagers etc. Most interfaces to SMTP are already provided by the cell phone service provider or the paging service provider.

Serial Connectivity

When using the serial connectivity with applications such as Hyper terminal etc. it may be necessary to optimize the character delays so that the FIFO buffer used in the GarrettCom Magnum 6K family of switches is not overrun. The important parameters to set for any serial connectivity software is to set the line delay to be 500 milliseconds and the character delay to be 50 milliseconds. For example, using Hyper Terminal this can be set under File → Properties and when the Properties sheet is open, click on the ASCII Setup button and in the Line Delay entry box enter in 500 and in the Character Delay entry box enter in 50 as shown below.

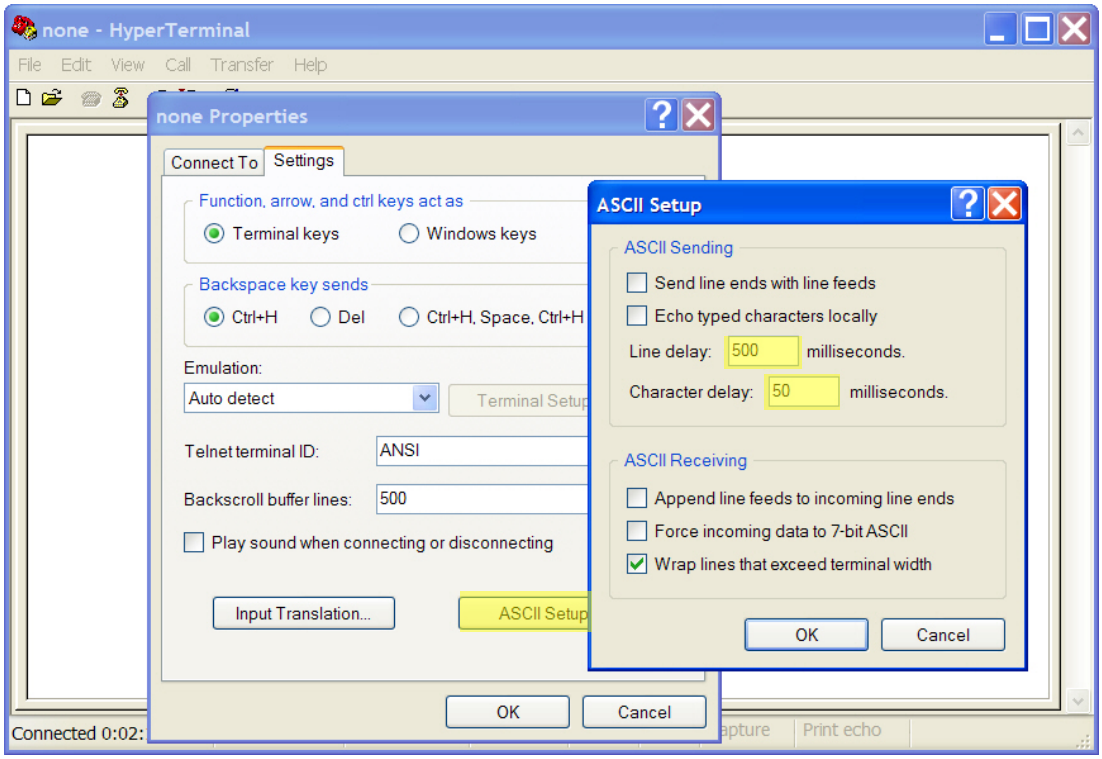


FIGURE 139 – *Optimizing serial connection (shown for Hyper Terminal on Windows XP). The highlighted fields are the ones to change as described*

Note – this is needed if you plan to cut and paste between a serial window and another file. This allows the buffer management of the serial port on the Magnum 6K family of switches.

Banner Message

The ability to change the banner message is available in MNS-6K-SECURE.

It is recommended to change the login message or the banner to a different one so as to deter unauthorized access. Some users may inadvertently connect to the switch. It would be fair top warn them that they have accessed a secure device and it is only appropriate to terminate the connection. Responsible users will follow the directive, much like a "No Trespassing" sign posted outside of the security fences.

MOTD stands for Message of the Day, a term used by system administrators to show the status of the system or inform the users of uses or abuses on the system.

To change the banner message, the following commands are used

Syntax **set motd** – *after the command is typed, MNS allows you to enter the Banner message*

Syntax **show motd** – *displays the current message set*

```
Copyright (c) 2001-2005 GarrettCom, Inc All rights reserved.
RESTRICTED RIGHTS
-----------------
Use, duplication or disclosure  is subject to  U.S. Government restrictions
as set forth in Sub-division (b)(3)(ii) of the rights in Technical Data and
Computer Software clause at 52.227-7013.

   GarrettCom Inc.
   47823 Westinghouse Drive
   Fremont, CA 94539
   USA

   www.garrettcom.com

MNS-6K version 14.1

Login    : manager
Password : *******

Magnum6K25# show motd

Motd is default

Magnum6K25# set motd

Enter MOTD. Finish by Empty Line, Cancel by Ctrl-C:
This is a secure device. Unauthorized access is prohibited.
```

Please disconnect if you are an unauthorized user. Thanks.

MOTD Updated. It will be displayed at next login.

Magnum6K25# show motd

Motd :

This is a secure device. Unauthorized access is prohibited.
Please disconnect if you are an unauthorized user. Thanks.

Magnum6K25# logout

Logging out from the current session...['Y' or 'N'] **Y**

Connection to host lost.

<After the session is terminated, a new session is opened up using telnet to display the effects of changing the MOTD on the switch>

C:> telnet switch

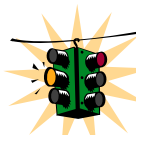
Copyright (c) 2001-2005 GarrettCom, Inc All rights reserved.

This is a secure device. Unauthorized access is prohibited.
Please disconnect if you are an unauthorized user. Thanks.

Magnum-6K Version 14.0

Login :

FIGURE 140 – *setting up a banner message*



MOTD message is part of the system group – a command such as "kill config save=system" will not erase the MOTD message. It is recommended to create a blank message in that situation.

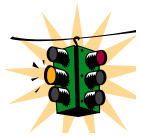
Miscellaneous commands

Some of the commands listed below may be useful in repeating several commands over and over again. They are

Syntax **!!** – *repeat the last command*

Syntax **!<n>** *- repeat the "n"th command (as indicated by a show history)*

Syntax **show history** – *show the last 25 commands executed – if less than 25 commands are executed, only those commands executed are shown*



If the user logs out or if the switch times out – the history is erased. The history count restarts when the user logs in again

Syntax **<Up-arrow>** *- every time the key is pressed, the last command is printed on the screen but not executed. This allows for editing errors made in typing*

Syntax **<Down-arrow>** *- opposite of Up-arrow key*

Syntax **show version** – *displays the version of MNS-6K being used*

Syntax **set history size=<1..100>** *- set the history commands to remember stack depth to be one command or up to a maximum of 100 commands*

```
Magnum6K25# show version

 MNS-6K Ver: 3.6 Date:Oct 20 2006 Time:17:22:35 Build ID 1161390154

Magnum6K25# show setup

 Version              : Magnum 6K25 build 14.1 Jul 28 2008 07:51:45
 MAC Address          : 00:20:06:25:ed:80
 IP Address           : 67.109.247.197
 Subnet Mask          : 255.255.255.224
 Gateway Address      : 67.109.247.193
 CLI Mode             : Manager
 System Name          : Magnum 6K25
 System Description   : 25 Port Modular Ethernet Switch
 System Contact       : support@garrettcom.com
 System Location      : HQ, Fremont, CA
 System ObjectId      : 1.3.6.1.4.1.553.12.6

Magnum6K25# show serial

 Baud Rate    : 38400
 Data         : 8
 Parity       : No Parity
 Stop         : 1
 Flow Control : None
```

```
Magnum 6K25# set history ?
set history        : Set History Size

Usage
set history size=<1-100>

Groups: All.

Magnum 6K25# set history size=100

 History Size is Set

Magnum6K25# show history

  1   :  show version
  2   :  show setup
  3   :  show serial
  4   :  show history

Magnum6K25# !1
show version
MNS-6K-Secure Ver: 14.1 Date:Jul 28 2008 Time:07:51:45 Build ID 1217245902

Magnum6K25#
```

FIGURE 141 – *History commands*

Prompt

Setting a meaningful host prompt can be useful when a network administrator is managing multiple switches and has multiple telnet or console sessions open at the same time. To facilitate this, MNS-6K allows administrators to define custom prompts. The command to set a prompt is

Syntax **set prompt <prompt string>**

The length of the prompt is limited to 60 characters

There are predefined variables which can be used to set the prompt. These are
$n : System Name
$c : System Contact
$l : System Location
$i : System IP
$m : System MAC
$v : Version

$$: $ Character
$r : New Line
$b : Space

A few examples on how the system prompt can be setup is shown below.

```
Magnum6K25# snmp
Magnum6K25(snmp)## setvar sysname=Core
  System variable(s) set successfully
Magnum6K25(snmp)## exit
Magnum6K25# set prompt $n
Core# set prompt $n$b$i
Core 192.168.5.5# set prompt $n$b$i$b
Core 192.168.5.5 # snmp
Core 192.168.5.5 (snmp)## setvar sysname=Magnum6K25
  System variable(s) set successfully
Core 192.168.5.5 (snmp)## exit
Core 192.168.5.5 # set prompt $b$b$i$b
  192.168.5.5 # set prompt $n$b$i$b
Magnum6K25 192.168.5.5 #
Magnum6K25 192.168.5.5 #
Magnum6K25 192.168.5.5 #
Magnum6K25 192.168.5.5 # set prompt Some$bthing$i
Some thing192.168.5.5# set prompt Some$bthing$b$i
Some thing 192.168.5.5#
```

FIGURE 142 – *Setting custom prompts*

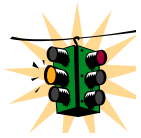
Ping

Ping command can be used from MNS-6K to test connectivity to other devices as well as checking to see if the IP address is setup correctly. The command is

Syntax **ping <ipaddress> [count=<1-999>] [timeout=<1-256>]** – *use the ping command to test connectivity*

```
Magnum6K25# ping 67.109.247.202

67.109.247.202 is alive, count 1, time = 40ms

Magnum6K25# ping 67.109.247.202 count=3

67.109.247.202 is alive, count 1, time = 20ms
67.109.247.202 is alive, count 2, time = 20ms
67.109.247.202 is alive, count 3, time = 40ms

Magnum6K25#
```

FIGURE 143 – *Using the ping command*



Many devices do not respond to ping or block ping commands. Make sure that the target device does respond or the network does allow the ping packets to propagate through.

FTP modes

The file transfer protocol or ftp is supported on MNS. MNS supports normal ftp as well as passive ftp. Passive FTP is used by many companies today to work with firewall policies and other security policies set by companies. The commands for setting the type of ftp are:

Syntax **set ftp mode=<normal|passive>** - *set the ftp mode of operation*

Syntax **show ftp**- *display the current ftp operation mode*

FTP uses a set of separate ports for the data stream and command stream. This causes problems in security conscious companies who prefer that the client initiate the file transfer as well as the stream for the commands. To accommodate that, ftp added the capability called "passive ftp" in which the client initiating the connection initiates both the data and command connection request. Most companies prefer passive ftp and MNS provides means to operate in those environments.

```
Magnum6K25# set ftp mode=passive

 FTP Set to Passive Mode
Magnum6K25# show ftp

 Current FTP Mode: PASSIVE
Magnum6K25#
```

FIGURE 144 - *Setting the FTP mode*

MNS-6K-SECURE supports secure ftp or sftp

System Events

All events occurring on the Magnum 6K family of switches are logged. The events can be as shown below

Code	Description
0	**Emergency** (or Fatal) system is unusable – called "fatal" in show log command
1	**Alert**: action must be taken immediately
2	**Critical**: critical conditions
3	**Error**: error conditions
4	**Warning**: warning conditions
5	**Notice**: normal but significant condition – called "note" in show log command
6	**Informational**: informational messages
7	**Debug**: debug-level messages

A few point to note about logs

- By default, the logging is limited to the first six levels
- The event log is now automatically saved to flash, so rebooting will not loose them. NOTE – since the event logs are written on the flash, once the flash memory is full, the logs stop writing. It is important to erase the log periodically or use syslog capability to download the logs to a syslog server (syslog is available on MNS-6K-SECURE only)
- The event log now includes more information, because of the additional flexibility built into the log engine. For example, it now logs the IP address and user name of a remote user login
- The log size parameter is now redefined as the max size of the log that is saved to flash. More events might appear in the log as they happen, but the whole list will be trimmed to the specified max size when a save command is issued, or the system rebooted.

These logs are in compliance with the definitions of RFC 3164, though not all the nuances of the syslog are implemented as specified by the RFC.

The **'show log'** command displays the log information and the **'clear log'** command clears the log entries.

The system events can be sent to a Syslog server using the Syslog capabilities in MNS-6K-SECURE. GarrettCom recommends that this capability should be used to centralize the logs.

```
Magnum6K25# show log

S   DATE         TIME          Log Description
--  --------     --------      ------------------------------------------------------------
I   03-02-2005   5:14:43 P.M   SYSMGR:System Subnet Mask changed
I   01-01-2001   12:00:00 A.M  SYSMGR:successfully registered with DB Manager
I   01-01-2001   12:00:00 A.M  SYSMGR:successfully read from DB
A   01-01-2001   12:00:00 A.M  VLAN:Vlan type set to Port VLAN
I   01-01-2001   12:00:00 A.M  SYSMGR:system was reset by user using CLI command
I   01-01-2001   12:00:00 A.M  SNTP:Date/Time set to 01-01-2001 12:00AM
I   01-01-2001   12:00:00 A.M  SNTP:Client started
I   03-03-2005   4:32:48 A.M   SNTP:Date and Time updated from SNTP server
I   03-03-2005   9:31:59 A.M   TELNET:Telnet Session Started
I   03-03-2005   9:32:04 A.M   CLI:manager console login
A   03-03-2005   9:32:11 A.M   IGMP:IGMP Snooping is enabled
A   03-03-2005   9:35:40 A.M   IGMP:IGMP Snooping is disabled
A   03-03-2005   9:41:46 A.M   IGMP:IGMP Snooping is enabled

Magnum6K25#
```

FIGURE 145 – *Event log shown on the screen*

Event logs can be exported to a ftp or a TFTP server on the network for further analysis or for other uses. To facilitate the export of the event log, the CLI command is exportlog as shown below

Syntax **exportlog mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>] [doctype=<raw|html>]** – *facilitates the export of the event log information as a text file or as an HTML file*

Where
mode=<serial|tftp|ftp> - is the mode of transfer
<ipaddress> - is the IP address of the ftp or TFTP server
file=<name> - is the file name – please make sure the proper file extension is used e.g html for an html file
doctype=<raw|html> - indicates the log is saved as a text file (raw) or as an HTML file

```
Magnum6K25# exportlog
Usage
  exportlog mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>] [doctype=<raw|html>]
Magnum6K25# exportlog mode=tftp 192.168.5.2 file=eventlog doctype=html
  Do you wish to export the event logs? [ 'Y' or 'N'] Y
  Successfully uploaded the event log file.
Magnum6K25# exportlog mode=tftp 192.168.5.2 file=eventlog.txt doctype=raw
```

```
Do you wish to export the event logs? [ 'Y' or 'N'] Y
Successfully uploaded the event log file.
Magnum6K25#
```

FIGURE 146 – *Using exportlog to export the event log information*

In the table below, the following acronyms are used for Severity:
E=Emergency; A=Alert; C=Critical; F=Fail or Error conditions; W=Warning; N=Notice; I=Informational and D=Debug

For the alerts, the events per subsystem function are listed below. The table is sorted by the subsystem function first and then by the severity level.

Intentionally left blank

Subsystem	Description	Severity
BRIDGE	Unable to delete MAC address from FDB	D
BRIDGE	Unable to insert MAC address to FDB	D
BRIDGE	Bridge init failed for ethx	F
BRIDGE	Bridge enable for ethx failed	F
BRIDGE	Bridge MIB init is done	I
CLI	Manager login at console	I
CLI	Operator login at console	I
CLI	Manager password changed	I
CLI	Operator password changed	I
DEVICE	Port x enabled	A
DEVICE	Port x disabled	A
DEVICE	Port X link down	A
DEVICE	Port X link up	A
DEVICE	Ethernet counters init failure	C
DEVICE	Unable to access ethernet counters	C
DEVICE	Failed to read saved system logs	D
DEVICE	Ethernet DMA init failure	F
DEVICE	Ethernet hardware error	F
DEVICE	Ethernet interrupt init failure	F
DEVICE	Unable to allocate ethernet memory	F
DEVICE	System started	I
DEVICE	Network Stack not yet configured	I
DEVICE	IP address a.b.c.d configured	I
DEVICE	subnetmask a.b.c.d configured	I
DEVICE	Default gateway a.b.c.d configured	I
DEVICE	Switch rebooted by user	I
DEVICE	No saved system logs	I
DEVICE	Timezone set to x	I
DEVICE	Country set to x (no DST)	I
DEVICE	Country set to x (DST valid)	I
DEVICE	Time set to x : y : z (HH:MM:SS) tz = a	I
DEVICE	Date set to x : y : z (HH:MM:YYYY)	I
PRTMR	Enabled by user monitor = x , sniffer = y	I
PRTMR	Disabled by user	I
PS	INTRUDER a:b:c:d:e:f @ port X , port disabled	A
PS	INTRUDER a:b:c:d:e:f @ port X , port disabled	A
PS	Port security enabled	A
PS	port security disabled	A
PS	Resetting MAC a:b:c:d:e:f at port X failed	C
PS	Unable to delete learnt MACs in hardware	D

Subsystem	Description	Severity
RMON	Alarm : internal error , unable to get memory	F
RMON	Alarm : internal error, unable to get memory for alarm entry	F
RMON	History : internal error, unable to get memory for history control entry	F
RMON	History : internal error, unable to get memory for history data entry	F
RMON	History : internal error, unable to get memory	F
RMON	Event : unable to get memory for event entry	F
RMON	Alarm : unable to get memory for RMON logs	F
RMON	rising alarm trap sent to a.b.c.d by alarm entry X	I
RMON	falling alarm trap sent to a.b.c.d by alarm entry X	I
RMON	RMON init is done	I
RMON	history : control entry X is set to valid	I
RMON	history : control entry X is set to invalid	I
RMON	Event : entry X is set to valid	I
RMON	Event : entry X is set to invalid	I
RMON	Alarm : entry X is set to valid	I
RMON	Alarm : entry X is set to invalid	I
SNMP	Snmp.snmpEnableAuthenTraps is set to enabled	A
SNMP	Snmp.snmpEnableAuthenTraps is set to disabled	A
SNMP	System.sysName configured	A
SNMP	System.sysLocation configured	A
SNMP	System.sysContact configured	A
SNMP	Port X link up trap sent to a.b.c.d	A
SNMP	Port X Link down trap sent to a.b.c.d	A
SNMP	Configuring IP address in trap receivers list failed	D
SNMP	read community string changed	I
SNMP	write community string changed	I
SNMP	trap community string changed	I
SNMP	authentication failure trap sent to a.b.c.d	I
SNMP	Trap receiver a.b.c.d added	I
SNMP	Trap receiver a.b.c.d deleted	I
SNMP	Coldstart trap sent to a.b.c.d	I
SNMP	Warmstart trap sent to a.b.c.d	I
SNTP	client started	I
SNTP	client stopped….disabled by user	I
SNTP	client stopped….server not configured	I
SNTP	Request timed out	I
SNTP	Retrying..	I
SNTP	Time synchronized through SNTP	I

Subsystem	Description	Severity
TCP/IP	Duplicate IP a.b.c.d sent from MAC address XXXXXX	C
TCP/IP	Unable to allocate memory for an ICMP packet	C
TCP/IP	IP packet from a.b.c.d , with checksum error dropped	D
TCP/IP	Bad IP fragments from a.b.c.d dropped	D
TCP/IP	UDP checksum error in the received packet a.b.c.d	D
TCP/IP	TCP checksum error in the received packet a.b.c.d	D
TCP/IP	ICMP checksum error in the received packet	D
TCP/IP	Failed to initialize the interface x	F
TCP/IP	IP packet of version X is dropped	I
VLAN	Type set to port	I
VLAN	Type set to mac	I
VLAN	Type set to tag	I
VLAN	Type set to none	I
VLAN	Pvlan: port based vlan started	I
VLAN	Pvlan: default vlan is modified	I
VLAN	Tvlan: Tag based vlan started	I
VLAN	pvlan:vlan X enabled	I
VLAN	pvlan:vlan X disabled	I
VLAN	pvlan:vlan X deleted	I
VLAN	pvlan:port based VLAN started	I
VLAN	pvlan:port based VLAN stopped	I
VLAN	pvlan:default vlan is modified	I
VLAN	tvlan:vlan X deleted	I
VLAN	tvlan:vlan X enabled	I
VLAN	tvlan:vlan X disabled	I
VLAN	tvlan:tag based VLAN stopped	I
VLAN	tvlan:tag based VLAN started	I

FIGURE 147 – *Listing of severity - sorted by subsystem and severity*

Please refer to the related chapters in this manual to find more information. For example, for the VLAN subsystem, refer to the chapter on VLAN.

MAC Address Table

Syntax **show address-table** – *displays the MAC addresses associated with ports – shows the MAC addresses on the ports and displays to which port the packet with the specified MAC addresses will be switched to*

Sometimes it is useful to see which port a specific packet will be switched to by examining the internal MAC address table. The **'show address-table'** command displays the internal switching table.

```
Magnum6K25# show address-table

Sl#         MAC Address          Port
-------------------------------------------------
1           01:00:5e:00:00:fb    0
2           00:0c:f1:b9:d1:dc    3
3           33:33:00:00:00:02    0
4           01:00:0c:cc:cc:cc    0
5           01:00:5e:00:00:16    0
6           00:07:50:ef:31:40    3
7           00:e0:81:52:85:96    3
8           01:40:96:ff:ff:ff    0
9           01:40:96:ff:ff:00    0
10          00:40:96:33:51:81    3

Magnum6K25#
```

FIGURE 148 – *Display of the internal switching decision table*

Where Sl# is the sequential listing form the memory and is just a sequence of the data as it appears in the memory. Port is the port number which the MAC address is assigned to. For example, if the packet with MAC address 00:0c:F1:B9:D1:DC (#2 above) appears with this MAC address in the DST field, the packet will be sent to port number 3. Also notice that there are other MAC addresses associated with port #3, indicating that the port has a hub or a switch connected to it.

List of commands in this chapter

Syntax **alarm** – *enter the alarm configuration mode*

Syntax **add event=<event-id|list|range|all>** - *enables alarm action in response to the specified event ID*

Syntax **period time=<1..10>** - *sets the duration of relay action for the momentary type signal. This may be needed to adjust to the behavior of the circuit or relay. Default is 3 seconds. Time is in seconds*

Syntax **del event=<event-id|list|range|all>** - *disables alarm action in response to the specified event ID*

Syntax **alarm <enable|disable>** - *globally enables or disables the alarm action*

Syntax **show alarm** - *displays the current status of Alarm system*

Syntax **set motd** – *after the command is typed, MNS allows you to enter the Banner message*

Syntax **show motd** – *displays the current message set*

Syntax **smtp** – *configure the SNMP alerts to be sent via email*

Syntax **show smtp <config|recipients>** - ***config*** – *displays the current SMTP global settings and* ***recipients*** *displays the currently configured recipients of email alerts*

Syntax **add id=<1-5> email=<email-addr> [traps=<all|none|S|R|E>] [events=<all|none|I|A|C|F|D>] [ip=<ip-addr>] [port=<1-65535>]**

id – [mandatory] the recipient ID - range from 1 to 5. MNS-6K allows a maximum of 5 recipients

email – [mandatory] email address of the recipient

traps – [optional] this is the trap filter. If value is "all", all traps of any type will be sent to this recipient. If value is none, no traps are sent to this recipient. Value can also be a combination of 'S' (SNMP), 'R' (RMON) and 'E' (ENTERPRISE). For example, trap=SR means that SNMP and RMON traps will be sent via email to the recipient. If this option is not defined, the recipient will have a default value of "all"

events – [optional] this is the event filter. Value can be "all" - all event severity types will be sent to recipient, "none" - no event will be sent to recipient or a combination of 'I' (informational), 'A' (activity), 'C' (critical), 'F' (fatal) and 'D' (debug). With **"event=ACF"** implies that events of severity types activity, critical and fatal will be sent to recipients by email. If this option is not defined, a value of "all" is taken

ip – [optional] SMTP server IP address. This is the SMTP server to connect to for this particular user. If this option is not defined, the global/default SMTP server is used

port – [optional] TCP port of the SMTP server. If this is not defined, the global default TCP port is used

Syntax **delete id=<1-5> -** *delete the specific id specified. The deleted id no longer receives the traps via email. The id is added using the "add" command*

Syntax **sendmail server=<ip-addr> to=<email-addr> from=<email-addr> subject=<string> body=<string>** - *customize (and also to send a test email to check SMTP settings) the email sent out by specifying the email subject field, server address, to field and the body of the text. See example fo the body of the text message later in this chapter*

server – [mandatory] SMTP server IP v4 address.

to – [mandatory] the recipient email address

from – [mandatory] the sender email address.

subject – [mandatory] email subject or title

body – [mandatory] email body

Syntax **server ip=<ip-addr> [port=<1-65535>] [retry=<0-3>]** – *configure the global SMTP server settings*

ip – [mandatory] SMTP server IP address

port – [mandatory] TCP port to be used for SMTP communications – default is 25

retry – [optional] specifies how many times to retry if an error occurs when sending email. Range from 0 to 3. Default is 0.

Syntax **smtp <enable|disable>** *- enables or disables SMTP to send SNMP alerts by email*

Syntax **exportlog mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>] [doctype=<raw|html>]** – *facilitates the export of the event log information as a text file or as an HTML file*

Syntax **!!** – *repeat the last command*

Syntax **!<n>** *- repeat the "n"th command (as indicated by a show history)*

Syntax **show history** – *show the last 25 commands executed – if less than 25 commands are executed, only those commands executed are shown*

Syntax **<Up-arrow>** *- every time the key is pressed, the last command is printed on the screen but not executed. This allows for editing errors made in typing*

Syntax **<Down-arrow>** *- opposite of Up-arrow key*

Syntax **show version** – *displays the version of MNS-6K being used*

Syntax **set ftp mode=<normal|passive>** *- set the ftp mode of operation*

Syntax **show ftp**- display the current ftp operation mode

Syntax **ping <ipaddress> [count=<1-999>] [timeout=<1-256>]** – *use the ping command to test connectivity*

Syntax **set prompt <prompt string>** *- set the prompt for switch. The prompt has predefined variables. These are $n : System Name; $c : System Contact; $l : System Location; $i : System IP; $m : System MAC; $v : Version; $$: $ Character; $r : New Line; $b : Space*

APPENDIX

1

APPENDIX 1 - Command listing by Chapter

A rich environment – this Appendix provides a reference to the commands by chapter

Chapter 2 – Getting Started

Syntax **ipconfig [ip=<ip-address>] [mask=<subnet-mask>] [dgw=<gateway>]** – *to set IP address on the switch*

Syntax **save** – *save changes made to the configuration*

Syntax **reboot** – *restart the switch – same effect as physically turning off the power*

Syntax **show setup** – *show setup parameters*

Syntax **show config** – *show setup parameters configured*

Syntax **enable <user-name>** - *changing the privilege level*

Syntax **add user=<name> level=<number>** - *adding a user*

Syntax **delete user=<name>** - *deleting a user*

Syntax **passwd user=<name>** - *changing a password for a user*

Syntax **chlevel user=<name> level=<number>** - *changing the user privilege level*

Syntax **useraccess user=<name> service=<telnet|web> <enable|disable>** - *defines the services available to the user to access the device for modifying the configuration*

Syntax **useraccess user=<name> group=<list> type=<read|write> <enable|disable>** - *set read or write access for the command group*

Syntax **useraccess groups** – *displays the current groups*

Syntax **help *<command string>*** *- help for a specific command*

Syntax **command *<Enter>*** *- options for a command*

Syntax **<TAB>** *- listing all commands available at the privilege level*

Syntax **<command string> <TAB>** *- options for a command*

Syntax **<first character of the command> <TAB>** *- listing commands starting with the character*

Syntax **logout** – *logout from the CLI session*

Syntax **authorize secure key=<16character license key>** *- Upgrade MNS-6K to MNS-6K-SECURE*

Chapter 3 – IP Address and System Information

Syntax **set bootmode type=<dhcp|bootp|manual|auto> [bootimg=<enable|disable>] [bootcfg=[<enable|disable>]** – *assign the boot mode for the switch*

Where

<dhcp|bootp|manual|auto> - where

dhcp – look only for DHCP servers on the network for the IP address. Disable bootp or other modes

bootp – look only for bootp servers on the network. Disable dhcp or other mode

manual – do not set the IP address automatically

auto - the switch will first look for a DHCP server. If a DHCP server is not found, it will then look for a BootP server. If that server is not found, the switch will check to see if the switch had a pre-configured IP address. If it did, the switch would be assigned that IP address. If the switch did not have a pre-configured IP address, it would inspect if the IP address 192.168.1.2 with a netmask of 255.255.255.0 is free. If the IP address is free, MNS-6K will assign the switch that IP address. If the address is not free, MNS-6K will poll the network for DHCP server then BootP server then check if the IP address 192.68.1.2 is freed up

bootimg=<enable|disable> - valid with type=bootp only. This option allows the switch to load the image file from the BootP server. This is useful when a new switch is put on a network and the IT policies are set to load only a specific MNS-6Kimage which is supported and tested by IT personnel.

bootcfg=<enable|disable> - valid with type=bootp only. This option allows the switch to load the configuration file from the BootP server. This is useful when a new switch is put on a network and the specific configurations are loaded from a centralized BootP server

Syntax **telnet <enable|disable>** *- enables or disables telnet sessions*

Syntax **telnet <ipaddress> [port=<port number>]** *– telnet from the switch*

Syntax **ssh <enable|disable|keygen>** *- enable or disable the server. Also can be used for generating the key used by ssh*

Syntax **ssh port=<port|default>** *- select a different port number for SSH communication*

Syntax **show ssh** *– display the ssh settings*

Syntax **set dns [server=<ip>] [domain=<domain name>] <enable|disable|clear>** *- specify a DNS server to look up domain names. The sever IP can be a IPV6 address as well as an IPV4 address*

Syntax **show dns –** *display the DNS settings*

Syntax **set serial [baud=<rate>] [data=<5|6|7|8>] [parity=<none|odd|even>] [stop=<1|1.5|2>] [flowctrl=<none|xonxoff>**] *– sets serial port parameters*

Syntax **snmp** *– enter the snmp configuration mode*

Syntax **setvar [sysname|syscontact|syslocation]=<string>** *- sets the system name, contact and location information*

Syntax **set timezone GMT=[+ or -] hour=<0-14> min=<0-59>** *- sets the timezone*

Syntax **set date year=<2001-2035> month=<1-12> day=<1-31> [format=<mmddyyyy|ddmmyyyy|yyyymmdd>]** *– sets the date and the format in which the date is displayed*

Syntax **set time hour=<0-23> min=<0-59> sec=<0-59>** *– sets the time (as well as the timezone)*

Syntax **set timeformat format=<12|24>** *- sets the display time in the 12/24 hour mode*

Syntax **set daylight country=< country name>** *- sets the daylight saving time*

Syntax **setsntp server = <ipaddress> timeout = <1-10> retry = <1-3>** *- setup the SNTP server*

Syntax **sync [hour=<0-24>] [min=<0-59>]** *– setup the frequency at which the SNTP server is queried*

Syntax **sntp [enable|disable]** *– enables or disables the SNTP services*

Syntax **saveconf mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>]** – *saves the configuration on the network using tftp, ftp or serial protocols*

Syntax **loadconf mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>]** – *loads the previously saved configuration from the network using tftp, ftp or serial protocols*

Syntax **kill config [save=module_name]** – *resets the system configuration. The module_name option does not reset the specific module parameters. The modules are system, event, port, bridge, stp, ps, mirror, sntp, vlan, gvrp and snmp*

Syntax **show session** – *display telnet sessions active on the switch*

Syntax **kill session id=<session>** *- kill a specific telnet session*

Syntax **set ftp mode=<normal|passive>** *- set the ftp mode of operation*

Syntax **show ftp***- display the current ftp operation mode*
Syntax **ftp <get|put|list|del> [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>] [user=<user>] [pass=<password>]** – *upload and download information using ftp command*

Where
<get|put|list|del> - different ftp operations
[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch
[host=<hostname>] [ip=<ipaddress>] [file=<filename>] [user=<user>] [pass=<password>] – parameters associated with ftp server for proper communications with the server

Syntax **stftp<get|put| list|del > [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>]** – *upload and download information using sftp command*

Where
<get|put| list|del > - different sftp operations – get a file from the server or put the information on the server or list files on the server or delete files from the server
[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch
[host=<hostname>] [ip=<ipaddress>] [file=<filename>] – parameters associated with tftp server for proper communications with the server

Syntax **tftp <get|put> [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>]** – *upload and download information using tftp command*

Where

<get|put> - different tftp operations – get a file from the server or put the information on the server

[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch

[host=<hostname>] [ip=<ipaddress>] [file=<filename>] – parameters associated with tftp server for proper communications with the server

Syntax **xmodem <get|put> [type=<app|config|oldconf|script|hosts|log>]** – *upload and download information using xmodem command and console connection*

Where

<get|put> - different xmodem file transfer operations – get a file from the server or put the information on the server

[type=<app|config|oldconf|script|hosts|log>] – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch

Syntax **host <add|edit|del> name=<host-name> [ip=<ipaddress>] [user=<user>] [pass=<password>]** – *create a host entry for accessing host. This is equivalent to creating a host table on many systems. Maximum of 10 such entries are allowed*

Syntax **show host** – *displays the host table entries*

Syntax **climode <script|console|show>** - *set the interactive CLI mode on (console) or off (script). To see the mode – use the show option*

Syntax **more <enable|disable|show>** - *enable or disable the scrolling of lines one page at a time*

Syntax **configure access** – *sets the access parameters (e.g. disable telnet session)*

Syntax **show ipconfig** – *shows IP parameters set*

Syntax **show console** – *reviews console settings*

Syntax **show serial** – *reviews serial settings*

Syntax **show setup** – *reviews system parameters*

Syntax **show sysconfig** – *reviews settable system parameters*

Syntax **show time** – *shows the system time*

Syntax **show timezone** – *shows the system timezone*

Syntax **show date** – *shows the system date*

Syntax **show uptime** – *shows the amount of time the switch has been operational*

Syntax **show config [module=<module-name>]** – *displays the configuration*

Syntax **set secrets <hide|show>** - *sets the system parameter to display or hide the passwords*

Syntax **kill config [save=module-name]** – *resets the system configuration. The module-name option does not reset the specific module parameters. The modules are listed below*

Chapter 4 – IPv6

Syntax **ipconfig [ip=<ip-address>] [mask=<subnet-mask>] [dgw=<gateway>] [add|del]** – *configure and IPv6 address. The add/delete option can be used to add or delete IPv4/IPv6 addresses*

Syntax **show ipconfig** – *display the IP configuration information – including IPv6 address*

Syntax **ping6 <IPv6 address>** - *pings an IPv6 station*

Syntax **show ipv6** - *displays the IPv6 information*

Syntax **ftp <IPv6 address>** - *ftp to an IPv6 station*

Syntax **telnet <IPv6 address>** - *telnet to an IPv6 station*

Chapter 5 – DHCP Server

Syntax - **dhcpsrv <start|stop>** - *start or stop the DHCP server. By default, the server is off*

Syntax - **config startip=<start ip> endip=<endip> mask=<mask> [dns=< dns1, dns2,..dns10>] [gateway=<gateway>] [leasetime=<lease time(1..10 hours)>]** – *configure the DHCP lease request parameters such as starting IP address, ending IP address, DNS server parameters, default gateway IP address and lease time*

Syntax – **addlease ip=<ip> mac=<mac> [leasetime=<lease time (1..10)>]** – *add a specific host with a specific IP address*

Syntax - **reserve-ip ip=<ip> [mac=<mac>]** - *reserve a specific IP address for a device*

Syntax - **clear-reserveip ip=<ip>** - *clear the reverse IP assigned*

Syntax - **show dhcpsrv <config|status|leases>** - *display the DHCP server configuration, leases as well as status*

Chapter 6 – SNTP Server

Syntax **sntpserver** – *enter the SNTP Server configuration mode*

Syntax **sntpsrv <start|stop>** - *Start or stop the SNTP Services*

Syntax **show sntpsrv** – *display the status of SNTP server*

Chapter 7 – Access Considerations

Syntax **set password** – *set or change password*

Syntax **configure port-security** – *sets the port authorization based on MAC addresses*

Syntax **port-security** – *configure port security settings*

Syntax **allow mac=<address|list|range> port=<num|list|range>** - *specify a specific MAC address or MAC address list*

Syntax **learn port=<number-list> <enable|disable>** - *learn MAC addresses connected to the Magnum 6K switch*

Syntax **show port-security** – *display port security settings*

Syntax **action port=<num|list|range> <none|disable|drop>** - *action to perform in case of breach of port security*

Syntax **signal port=<num|list|range> <none|log|trap|logandtrap>** *- port to monitor and signal to send in case of breach of port security*

Syntax **ps <enable|disable>** *- enable or disable port security*

Syntax **remove mac=<all|address|list|range> port=<num|list|range>** *- remove a MAC address entry*

Syntax **show log [fatal|alert|crit|error|warn|note|info|debug]** *– display the log*

Syntax **clear log [fatal|alert|crit|error|warn|note|info|debug]***– clear the log*

Syntax **set logsize size=<1-1000>** *- set the number of line to be collected in the log before the oldest record is re-written*

Syntax **syslog** *– syslog context commands*

Syntax **server add host=<host|ip> [port=<port>] [event=<all|none|default|list>]** *– add a syslog server. Maximum of five servers can be defined*

Syntax **server edit id=<id> [host=<host|ip>] [port=<port>] [event=<all|none|default|list>]** *- edit the server setup as well as which syslog messages the server should receive*

Syntax **server del id=<id>** *- delete a Syslog server*

Syntax **server <enable|disable> id=<id>** *- enable or disable the log messages being sent to a syslog server*

Syntax **syslog <enable|enable>** *- enable (or disable) the syslog messages*

Syntax **access** *– setup access configuration parameters*

Syntax **allow ip=<ipaddress> mask=<netmask> service=<name|list>** *- allow specific IP address or range of addresses as a trusted host(s)*

Syntax **deny ip=<ipaddress> mask=<netmask> service=<name|list>** *- deny specific IP address or range of IP addresses*

Syntax **remove ip=<ipaddress> mask=<netmask>** *- delete a specific IP address from the access or trusted host list*

Syntax **removeall** *– remove all IP addresses of trusted hosts*

Syntax **show ip-access** *– display all trusted hosts*

Syntax **clear <history|log [1..5 |informational |activity |critical |fatal |debug] |terminal |arp|portstats|addr]** – *clear command to clear various aspects of the MNS-6K information – most notably "clear addr" – clears the addresses learnt or "clear log" to clear the logs (and the type of logs)*

Chapter 8 – Access Using Radius

Syntax **auth** *configuration mode to configure the 802.1x parameters*

Syntax **show auth <config|ports>** *show the 802.1x configuration or port status*

Syntax **authserver [ip=<ip-addr>] [udp=<num>] [secret=<string>]** *define the RADIUS server – use UDP socket number if the RADIUS authentication is on port other than 1812*

Syntax **auth <enable|disable>** *enables or disables the 802.1x authenticator function on MNS-6K switch*

Syntax **setport port=<num|list|range> [status=<enable|disable>] [control=<auto|forceauth|forceunauth>] [initialize=<assert|deassert>]** *setting the port characteristic for an 802.1x network*

Syntax **backend port=<num|list|range> supptimeout=<1-240>] [servertimeout=<1-240>] [maxreq=<1-10>]** *configure parameters for EAP over RADIUS*

port – [mandatory] – port(s) to be configured
supptimeout – [optional] This is the timeout in seconds the authenticator waits for the supplicant to respond back. Default value is 30 seconds. Values can range from 1 to 240 seconds.
servertimeout – [optional] This is the timeout in seconds the authenticator waits for the backend RADIUS server to respond back. The default value is 30 seconds. Values can range from 1 to 240 seconds.
maxreq – [optional] The maximum number of times the authenticator will retransmit an EAP Request packet to the Supplicant before it times out the authentication session. Its default value is 2. It can be set to any integer value from 1 to 10.

Syntax **portaccess port=<num|list|range> [quiet=<0-65535>] [maxreauth=<0-10>] [transmit=<1-65535>]** *set port access parameters for authenticating PCs or supplicants*

port – [mandatory] – ports to be configured
quiet – [optional] This is the quiet period, the amount of time, in seconds, the supplicant is held after an authentication failure before the authenticator retries the supplicant for connection. The default value is 60 seconds. Values can range from 0 to 65535 seconds.
maxreauth – [optional] The number of re-authentication attempts that are permitted before the port becomes unauthorized. Default value is 2. Values are integers and can range from 0 to 10.

transmit – [optional] This is the transmit period, this is the time in seconds the authenticator waits to transmit another request for identification from the supplicant. Default value is 30. Values can be from 1 to 65535 seconds

Syntax **reauth port=<num|list|range> [status=<enable|disable>] [period=<10-86400>]** *set values on how the authenticator (Magnum 6K switch) does the re-authentication with the supplicant or PC*

port – [mandatory] – ports to be configured
status – [optional] This enables/disables re-authentication
period – [optional] this is the re-authentication period in seconds. This is the time the authenticator waits before a re-authentication process will be done again to the supplicant. Default value is 3600 seconds (1 hour). Values can range from 10 to 86400 seconds.

Syntax **show-stats port=<num>** *displays 802.1x related statistics*

Syntax **trigger-reauth port=<num|list|range>** *manually initiate a re-authentication of supplicant*

Chapter 9 – Access using TACACS+

Syntax **show tacplus <status|servers>** - *show status of TACACS or servers configured as TACACS+ servers*

Syntax **tacplus <enable|disable> [order=<tac,local | local,tac>]** - *enable or disable TACACS authentication, specifying the order in which the server or local database is looked up where "tac,local" implies, first the TACAS+ server, then local logins on the device*

Syntax **tacserver <add|delete> id=<num> [ip=<ip-addr>] [port=<tcp-port>] [encrypt=<enable|disable>] [key=<string>] [mgrlevel=<level>] [oprlevel=<level>]** – *adds a list of up to five TACACS+ servers where*
<add|delete> – [mandatory] adds or delete a TACACS+ server.
id=<num> – [mandatory] the order in which the TACACS+ servers should be polled for authenticaton
[ip=<ip-addr>] – [mandatory for add] the IP address of the TACACS+ server
[port=<tcp-port>] – [optional for add] TCP port number on which the server is listening
[encrypt=<enable|disable>] – [optional for add] enable or disable packet encryption
[key=<string>] – [optional for add, mandatory with encrypt] when encryption is enabled, the secret shared key string must be supplied
[mgrlevel=<level>] and **[oprlevel=<level>]** – [optional] specifies the manager and operator level as defined on the TACACS+ server for the respective level of login

Chapter 10 – Port mirroring and setup

Syntax **show port-mirror** – *display port mirror settings*

Syntax **port-mirror <enter>** - *configure port mirror settings*

Syntax **setport monitor=<monitor port number> sniffer=<sniffer port number>** - *set port mirror settings*

Syntax **prtmr <enable|disable>** - *enable or disable port mirror settings*

Syntax **device** – *configure device and port specific settings*

Syntax **setport port=<port#|list|range> [name=<name>] [speed=<10|100>] [duplex=<half|full>] [auto=<enable|disable>] [flow=<enable|disable>] [bp=<enable|disable>] [status=<enable|disable>]** – *configure port settings*

Syntax **show port[=<Port number>]** – *display port settings*

Syntax **flowcontrol xonlimit=<value> xofflimit=<value>** - *configure flow control buffers*

Syntax **show flowcontrol** – *display flow control buffers*

Syntax **backpressure rxthreshold=<value>** - *configure backpressure buffers*

Syntax **show backpressure** – *display backpressure buffers*

Syntax **broadcast-protect <enable|disable>** - *protect switch from broadcast storms*

Syntax **rate-threshold port=<port|list|range> rate=<frames/sec>** - *change the allowed broadcast rate threshold*

Chapter 11 - VLAN

Syntax **set vlan type=<tag|none>** *defines the VLAN type*

Syntax **vlan <enable|disable>** - *allow VLAN commands or configure vlan commands*

Syntax **vlan** – *enter the subset of VLAN commands*

Syntax **add id=<vlan Id> [name=<vlan name>] port=<number|list|range> [forbid=<number|list|range>] [<mgt|nomgt>] -** *adding VLAN*

Syntax **start vlan=<name|number|list|range>** *activate the VLAN configuration*

Syntax **save** *save the configuration (including the VLAN configuration)*

Syntax **edit id=<vlan id> [name=<vlan name>] port=<number|list|range> [<mgt|nomgt>] -** *edit existing VLAN name*

Syntax **show vlan [<id=vlanid>]** *display specific VLAN information*

Syntax **set-port port=<number|list|range> default id=<number>** *sets the default VLAN id. For Magnum 6K family of switches, the default VLAN id is 1, unless changed using this command*

Syntax **set-port port=<number|list|range> filter status=<enable|disable>** *enables or disables the VLAN filtering function.*

Syntax **set-port port=<number|list|range> tagging id=<number> status=<tagged|untagged>** *defines whether the outgoing packets from a port will be tagged or untagged.*

Syntax **set-port port=<number|list|range> join id=<number>** *adds the specified port(s) to the specified VLAN id*

Syntax **set-port port=<number|list|range> leave id=<number>** *releases a specific port from a VLAN*

Syntax **show-port [port=<port|list|range>]** *shows all parameters related to tag vlan for the list of ports. If the port parameter is omitted, it will display all ports*

Chapter 12 – Spanning Tree Protocol (STP)

Syntax **show stp <config|ports > -** *regardless of whether STP is enabled or disabled (default) this command lists the switch's full STP configuration, including general settings and port settings*

Syntax **stp** – *STP Configuration mode*

Syntax **stp <enable|disable>** *- Start (Enable) or stop (Disable) STP*

Syntax **priority [port=<number|list|range>] value=<0-255 | 0-65535> -** *specifies the port or switch level priority. When a port(s) are specified the priority is associated with ports and their value is 0-255. If no ports are specified, then the switch (bridge) priority is specified and its value is 0-65535*

Syntax **cost port=<number|list|range> value=<0-65535>** *- cost is specific to a port and the port(s) have to be specified*

Syntax **port port=<number|list|range> status=<enable|disable>** *- specific ports may not need to participate in STP process. These ports typically would be end-stations. If you are not sure – let MNS-6K software make the decisions*

Syntax **timers forward-delay=<4-30> hello=<1-10> age=<6-160>** *- change the STP Forward Delay, Hello timer and Aging timer values*

Chapter 13 – Rapid Spanning Tree Protocol

Syntax **set stp type=<stp|rstp> -** *Set the switch to support RSTP or change it back to STP. Need to save and reboot the switch after this command*

Syntax **rstp** – *enter the RSTP configuration mode*

Syntax **rstp <enable|disable>** *- enable RSTP – by default, this is disabled and has to be manually activated*

Syntax **port port=<number|list|range> [status=<enable|disable>] [migration=<enable>] [edge=<enable|disable>] [p2p=<on|off|auto>]** *- set the port type for RSTP*

Example **port port=<number|list|range> p2p= off** *- Set the "point-to-point" value to off on all ports that are connected to* ***shared LAN segments*** *(i.e. connections to hubs). The default value is auto. P2P ports would typically be end stations or computers on the network*

Example **port port=<number|list|range> edge=enable** – *enable all ports connected to other hubs, bridges and switches as edge ports*

Example **port port=<number|list|range> migration=enable** – *set this for all ports connected to other devices such as hubs, bridges and switches known to support IEEE 802.1d STP services, but cannot support RSTP services*

Syntax **show active-stp** – *status whether STP or RSTP is running*

Syntax **show rstp <config|ports>** *- display the RSTP or STP parameters*

Syntax **forceversion <stp|rstp>** *- set the STP or RSTP compatibility mode*

Syntax **show-forceversion** *- the current forced version*

Syntax **show-timers** *- show the values of the timers set for RSTP*

Syntax **priority [port=<number|list|range>] value=<0-255 | 0-65535>** *- specifies the port or switch level priority. When a port(s) are specified the priority is associated with ports and their value is 0-255. If no ports are specified, then the switch (bridge) priority is specified and its value is 0-65535*

Syntax **cost port=<number|list|range> value=<0-65535>** *- cost is specific to a port and the port(s) have to be specified*

Syntax **port port=<number|list|range> status=<enable|disable>** *- specific ports may not need to participate in STP process. These ports typically would be end-stations. If you are not sure – let MNS-6K software make the decisions*

Syntax **timers forward-delay=<4-30> hello=<1-10> age=<6-160>** *- change the STP Forward delay, Hello timer and Aging timer values*

Chapter 14 – S-Ring and Link-Loss-Learn

Syntax **authorize <module> key=<security key>** *- activate the S-Ring capabilities. Don't forget to use the "save" command to save the key*

Syntax **stp** *– STP Configuration mode*

Syntax **stp <enable|disable>** *- Start (Enable) or stop (Disable) STP*

Syntax **set stp type=<stp|rstp>** *- set the spanning tree protocol to be IEEE 802.1d or 802.1w (Spanning Tree Protocol or Rapid Spanning Tree Protocol)*

Syntax **show active-stp** *– Display which version of STP is currently active*

Syntax **show s-ring** *– show the status of S-ring status and configuration*

Syntax **s-ring <enable|disable>** *- enable or disable S-ring capabilities*

Syntax **s-ring learn** *– start the learning process to discover the ring and the ports which make up the S-ring*

Syntax **s-ring add port=<port1,port2>** *- define ports which make up the S-ring ports. Note as discussed earlier, you can create multiple s-rings on a switch*

Syntax **s-ring del port=<port1,port2>** *- remove the switch from S-ring topology by eliminating the end ports on the switch*

Syntax **lll <enable|disable>** *- enable or disable LLL on the switch*

Syntax **lll add port=<port|list|range>** *- enable LLL on the list of specified ports*

Syntax **lll del port=<port|list|range>** *- disable LLL on the list of specified ports*

Syntax **show lll** – *display the status of LLL*

Syntax **rstp** – *STP Configuration mode*

Syntax **rstp <enable|disable>** *- Start (Enable) or stop (Disable) STP*

Syntax **set stp type=<stp|rstp>** *- set the spanning tree protocol to be IEEE 802.1d or 802.1w (Rapid Spanning Tree Protocol)*

Syntax **show active-stp** – *Display which version of STP is currently active*

Chapter 15 – Dual-Homing

Syntax **dualhome** – *enter the dual-homing configuration sub-system*

Syntax **dualhome <enable|disable>** – *enable or disable dual-homing*

Syntax **dualhome add port1=<port#> port2=<port#>** – *dual-homing setup similar to that of unmanaged switches such as ESD42*

OR

Syntax **dualhome add primary=<port#> secondary=<port#>** – *dual-homing setup as primary-secondary mode*

Syntax **dualhome del** – *Delete the dual-homing setup*

Syntax **show dualhome** – *Display dual-homing status*

Chapter 16 – Link Aggregation Control Protocol (LACP)

Syntax **lacp** *- enable the LACP configuration module within CLI*

Syntax **lacp <enable | disable>** *- enable or disable LACP*

Syntax **add port=<number|list|range> [priority=<0-65535>]** – *add the specified list of ports to form the logical LACP trunk. Default value for priority is 32768. The lower the value assigned to*

priority, the higher the priority. The port with the highest priority is the primary port (over which certain types of traffic like IGMP is transmitted)

Syntax **del port=<number|list|range>** *- delete specified ports from the LACP membership*

Syntax **edit port=<number|list|range> [priority=<priority>]** *- edit the membership of the ports specified. The priority can be from 0 – 65535*

Syntax **show lacp** *– displays the status and other relevant LACP information*

Chapter 17 – Quality of Service

Syntax **qos –** *enter the QoS configuration mode*

Syntax **setqos type=<port|tag|tos|none> [port=<port|list|range>] [priority=<high|low>] [tos=<0-63|list|range>][tag=<0-7|list|range>]** *- depending on the type of QOS, the corresponding field has to be set. For example, for QOS type tag, the tag levels have to be set, and for QOS type ToS, the ToS levels have to be set. If the priority field is not set, it then defaults to low priority. ToS has 64 levels and the valid values are 0-63 and a tagged packet has 8 levels and the valid values are 0-7.*

Syntax **set-weight weight=<0-7>** *- sets the port priority weight for All the ports. Once the weight is set, all the ports will be the same weight across the switch. The valid value for weight is 0-7*

Syntax **show-portweight** *- display the weight settings on a port*

Syntax **show qos [type=<port|tag|tos>] [port=<port|list|range>]** *– displays the QoS settings*

Syntax **set-untag port=<port|list|range> priority=<high|low> tag=<0-7>** *- The 802.1p user priority assigned to untagged received packets to be transmitted as tagged from the priority queue*

Chapter 18 - IGMP

Syntax **igmp** *– IGMP configuration mode*

Syntax **igmp <enable/disable>** *- enable or disable IGMP on the switch*

Syntax **show igmp** *– IGMP operation status*

Syntax **mcast <enable | disable>** *- enable or disable unknown multicast streams. The default is enabled*

Syntax **set igmp mode= <normal|l2>** *- set the IGMP mode. Normal is when a L3 device is in the network and is the IGMP root. The IGMP-L2 is used when there is no L3 device in the network*

Syntax **group add ip=<group ip> port=<number|list|range> vlan=<vlanid>** *- add ports to a specific IGMP broadcast*
group del ip=<group ip> *- delete ports from a specific IGMP broadcast group*

Syntax **show-group** – *shows the multicast groups*

Syntax **set-port port=< port|list|range> mode=<auto|forward|block>** *- set the port characteristics. Block drops the unregistered multicasts. Forward forwards unregistered multicasts*

Syntax **show-port** – *display the port characteristics for IGMP*

Syntax **show-router** – *displays detected IGMP-enabled router ports*

Syntax **set-leave <enable|disable>** *- enables or disables the switch to immediately process a host sending a leave message rather that wait for the timer to expire*

Syntax **set-querier <enable|disable>** *- enables or disables a switch as IGMP querier*

Syntax **set-qi interval=<value>** *- The IGMP querier router periodically sends general host-query messages. These messages are sent to ask for group membership information. This is sent to the all-system multicast group address, 224.0.0.1. The default value is 125 seconds. The valid range can be from 60 to 127 seconds.*

Syntax **set-qri interval=<value> -** *The query response interval is the maximum amount of time that can elapse between when the querier router sends a host-query message and when it receives a response from a host. The Default value is 10 seconds. The Range can be from 2 to 270 seconds. Restrictions apply to the maximum value because of an internal calculation that is dependent on the value of the Query Interval*

Syntax **mode=<l2|normal> -** *Toggle the IGMP mode from L2 to nnormal or IGMP-L2*

Chapter 19 - GVRP

Syntax **show gvrp** *- shows whether GVRP is disabled, along with the current settings for the maximum number of VLANs and the current Primary VLAN*

Syntax **gvrp <enable|disable>** *- enable or disable GVRP*

Syntax **show-vlan** – *list all the VLANs (including dynamic VLANs) on the switch*

Syntax **set-ports port=<port|list|range> state=<learn|block|disable>** *- set the state of the port to learn, block or disable for GVRP. Note the default state is disable*

Syntax **static vlan=<VID>** *- convert a dynamic VLAN to a static VLAN*

Syntax **set-forbid vlan=<tag vlanid> forbid=<port-number|list|range>** *- sets the forbid GVRP capability on the ports specified*

Syntax **show-forbid** – *display the ports with GVRP forbid capabilities*

Chapter 20 – SNMP

Syntax **snmp** – *enter the SNMP Configuration mode*

Syntax **snmpv3** – *enter the SNMP V3 configuration mode – note enable SNMP V3 by using the* ***"set snmp"*** *command which follows*

Syntax **set snmp type=<v1|all>** *- define the version of SNMP to use – the option all supports all versions (v1, v2 and v3) – v1 restricts SNMP to v1 only. By default – SNMP v1only is enabled*

Syntax **show active-snmp** – *shows the version of SNMP currently in use*

Syntax **community [write=<write community>] [read=<read community>] [trap=<trap community>]** – *set the necessary community strings*

Syntax **authtraps <enable|disable>** *- enables or disables authentication traps generation*

Syntax **traps <add|delete> type=<Snmp|Rmon|Snmp,Rmon|Enterprise|Snmp,Enterprise |Rmon,Enterprise|All> ip=<ipaddress>** *- add v1 traps as well as define the trap receiver*

Syntax **show snmp** – *displays the SNMP configuration information*

Syntax **mgrip <add|delete> ip=<IPaddress>** *- adds or deletes a management station, specified by the IP address, which can query SNMP variables from the switch. This is done to protect the switch from being polled by unauthorized managers. Maximum of five stations allowed.*

Syntax **setvar [sysname|syscontact|syslocation]=<string>** *sets the system name, contact and location. All parameters are optional but a user must supply at least one parameter*

Syntax **quickcfg** *- quick setup for snmpv3 configuration. It automatically configures a default VACM (view-based access control model). This allows any manager station to access the Magnum 6K switch either via SNMP v1, v2c or v3. The community name is "public". This command is only intended for first time users and values can be changed by administrators who want more strict access*

Syntax **engineid string=<string>** *- Every agent has to have an engineID (name) to be able to respond to SNMPv3 messages. The default engine ID value is "6K_v3Engine". This command allows the user to change the engine ID*

Syntax **authtrap <enable|disable>** *- enables or disables authentication traps generation*

Syntax **show-authtrap** *- displays the current value of authentication trap status.*

Syntax **deftrap community**=<string> *- defines the default community string to be used when sending traps. When user does not specify the trap community name when setting a trap station using the "trap" command, the default trap community name is used*

Syntax **show-deftrap** *- displays the current value of default trap*

Syntax **trap <add|delete> id=<id> [type=<v1|v2|inform>] [host=<host-ip>] [community=<string>] [port=<1-65534>] -** *define the trap and inform manager stations. The station can receive v1, v2 traps and/or inform notifications. An inform notification is an acknowledgments that a trap has been received. A user can add up to 5 stations.*

Syntax **show-trap [id=<id#>]***- shows the configured trap stations in tabular format - id is optional and is the number corresponding to the trap entry number in the table*

Syntax **com2sec <add|delete> id=<id> [secname=<name>] [source=<source>] [community=<community>]** *- a part of the View based Access control model (VACM) as defined in RFC 2275. This specifies the mapping from a source/community pair to a security name. On MNS-6K, up to 10 entries can be specified*

Syntax **group <add|delete> id=<id> [groupname=<name>] [model=<v1|v2c|usm>] [com2secid=<com2sec-id>]** *- a part of the View based Access control model (VACM) as defined in RFC 2275. This command defines the mapping from sec model or a sec name to a group. A sec model is one of v1, v2c, or usm. On MNS-6K, up to 10 entries can be specified*

Syntax **show-group [id=<id>]** *- display all or specific group entries - id is optional and is the number corresponding to the group entry number in the table*

Syntax **view <add|delete> id=<id> [viewname=<name>] [type=<included|excluded>] [subtree=<oid>] [mask=<hex-string>]** *- a part of the View based Access control model (VACM) as defined in RFC 2275. This command defines a manager or group or manager stations what it can access inside the MIB object tree. On MNS-6K, up to 10 entries can be specified*

Syntax **show-view [id=<id>]** *- display all or specific view entries - id is optional and is the number corresponding to the view entry number in the table*

Syntax **user <add|delete> id=<id> [username=<name>] [usertype=<readonly|readwrite>] [authpass=<pass-phrase>] [privpass=<pass-phrase>] [level=<noauth|auth|priv>] [subtree=<oid>]** *for quickly adding or deleting v3 USM based security, this command adds user entries. MNS-6K allows up*

to 5 users to be added. Right now, the MNS-6K agent only support noauth and auth-md5 for v3 authentication and auth-des for priv authentication

Syntax **show-user [id=<id>]** *- display all or specific view entries - id is optional and is the number corresponding to the view entry number in the table*

Syntax **rmon** – *enter the RMON configuration mode to setup RMON groups and communities*

Syntax **history def-owner=<string> def-comm=<string>** *- define the RMON history group and the community string associated with the group*

Syntax **statistics def-owner=<string> def-comm=<string>***- define the RMON statistics group and the community string associated with the group*

Syntax **alarm def-owner=<string> def-comm=<string>** *- define the RMON alarm group and the community string associated with the group*

Syntax **event def-owner=<string> def-comm=<string>** *- define the RMON event group and the community string associated with the group*

Syntax **show rmon <stats|hist|event|alarm>** *- list the specific RMON data as defined by the group type*

Chapter 21 – Miscellaneous Commands

Syntax **alarm** – *enter the alarm configuration mode*

Syntax **add event=<event-id|list|range|all>** *- enables alarm action in response to the specified event ID*

Syntax **period time=<1..10>** *- sets the duration of relay action for the momentary type signal. This may be needed to adjust to the behavior of the circuit or relay. Default is 3 seconds. Time is in seconds*

Syntax **del event=<event-id|list|range|all>** *- disables alarm action in response to the specified event ID*

Syntax **alarm <enable|disable>** *- globally enables or disables the alarm action*

Syntax **show alarm** *- displays the current status of Alarm system*

Syntax **set motd** – *after the command is typed, MNS allows you to enter the Banner message*

Syntax **show motd** – *displays the current message set*

Syntax **smtp** – *configure the SNMP alerts to be sent via email*

Syntax **show smtp <config|recipients>** - ***config*** – *displays the current SMTP global settings and* ***recipients*** *displays the currently configured recipients of email alerts*

Syntax **add id=<1-5> email=<email-addr> [traps=<all|none|S|R|E>] [events=<all|none|I|A|C|F|D>] [ip=<ip-addr>] [port=<1-65535>]**

id – [mandatory] the recipient ID - range from 1 to 5. MNS-6K allows a maximum of 5 recipients

email – [mandatory] email address of the recipient

traps – [optional] this is the trap filter. If value is "all", all traps of any type will be sent to this recipient. If value is none, no traps are sent to this recipient. Value can also be a combination of 'S' (SNMP), 'R' (RMON) and 'E' (ENTERPRISE). For example, trap=SR means that SNMP and RMON traps will be sent via email to the recipient. If this option is not defined, the recipient will have a default value of "all"

events – [optional] this is the event filter. Value can be "all" - all event severity types will be sent to recipient, "none" - no event will be sent to recipient or a combination of 'I' (informational), 'A' (activity), 'C' (critical), 'F' (fatal) and 'D' (debug). With **"event=ACF"** implies that events of severity types activity, critical and fatal will be sent to recipients by email. If this option is not defined, a value of "all" is taken

ip – [optional] SMTP server IP address. This is the SMTP server to connect to for this particular user. If this option is not defined, the global/default SMTP server is used

port – [optional] TCP port of the SMTP server. If this is not defined, the global default TCP port is used

Syntax **delete id=<1-5> -** *delete the specific id specified. The deleted id no longer receives the traps via email. The id is added using the "add" command*

Syntax **sendmail server=<ip-addr> to=<email-addr> from=<email-addr> subject=<string> body=<string>** *- customize (and also to send a test email to check SMTP settings) the email sent out by specifying the email subject field, server address, to field and the body of the text. See example fo the body of the text message later in this chapter*

server – [mandatory] SMTP server IP v4 address.

to – [mandatory] the recipient email address

from – [mandatory] the sender email address.

subject – [mandatory] email subject or title

body – [mandatory] email body

Syntax **server ip=<ip-addr> [port=<1-65535>] [retry=<0-3>]** – *configure the global SMTP server settings*

ip – [mandatory] SMTP server IP address

port – [mandatory] TCP port to be used for SMTP communications – default is 25

retry – [optional] specifies how many times to retry if an error occurs when sending email. Range from 0 to 3. Default is 0.

Syntax **smtp <enable|disable>** *- enables or disables SMTP to send SNMP alerts by email*

Syntax **exportlog mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>] [doctype=<raw|html>]** – *facilitates the export of the event log information as a text file or as an HTML file*

Syntax **!!** – *repeat the last command*

Syntax **!<n>** *- repeat the "n"th command (as indicated by a show history)*

Syntax **show history** – *show the last 25 commands executed – if less than 25 commands are executed, only those commands executed are shown*

Syntax **<Up-arrow>** *- every time the key is pressed, the last command is printed on the screen but not executed. This allows for editing errors made in typing*

Syntax **<Down-arrow>** *- opposite of Up-arrow key*

Syntax **set ftp mode=<normal|passive>** *- set the ftp mode of operation*

Syntax **show ftp**- display the current ftp operation mode

Syntax **show version** – *displays the version of MNS-6K being used*

Syntax **ping <ipaddress> [count=<1-999>] [timeout=<1-256>]** – *use the ping command to test connectivity*

Syntax **set prompt <prompt string>** *- set the prompt for switch. The prompt has predefined variables. These are $n : System Name; $c : System Contact; $l : System Location; $i : System IP; $m : System MAC; $v : Version; $$: $ Character; $r : New Line; $b : Space*

APPENDIX

2

APPENDIX 2 - Commands sorted alphabetically

Command	Description
!!	*repeat the last command*
!<n>	*repeat the "n"th command (as indicated by a show history)*
<command string> <TAB>	*options for a command*
<Down-arrow>	*opposite of Up-arrow key*
<first character of the command> <TAB>	*listing commands starting with the character*
<TAB>	*listing all commands available at the privilege level*
<Up-arrow>	*every time the key is pressed, the last command is printed on the screen but not executed. This allows for editing errors made in typing*
access	*setup access configuration parameters*
action port=<num|list|range> <none|disable|drop>	*action to perform in case of breach of port security*
add event=<event-id|list|range|all>	*enables alarm action in response to the specified event ID*
add id=<1-5> email=<email-addr> [traps=<all|none|S|R|E>] [events=<all|none|I|A|C|F|D>] [ip=<ip-addr>] [port=<1-65535>]	*setup email id for receiving SNMP trap information by email*
add id=<vlan Id> [name=<vlan name>] port=<number|list|range> [forbid=<number|list|range>] [<mgt|nomgt>]	*adding VLAN*
add user=<name> level=<number>	*adding a user*

Command	Description
add port=<number|list|range> [priority=<0-65535>]	*add the specified list of ports to form the logical LACP trunk. Default value for priority is 32768. The lower the value assigned to priority, the higher the priority. The port with the highest priority is the primary port (over which certain types of traffic like IGMP is transmitted). Requires the lacp command (module).*
addlease ip=<ip> mac=<mac> [leasetime=<lease time (1..10)>]	*add a specific host with a specific IP address*
alarm	*enter the alarm configuration mode*
alarm <enable|disable>	*globally enables or disables the alarm action*
alarm def-owner=<string> def-comm=<string>	*define the RMON alarm group and the community string associated with the group*
allow ip=<ipaddress> mask=<netmask> service=<name|list>	*allow specific IP address or range of addresses as a trusted host(s)*
allow mac=<address|list|range> port=<num|list|range>	*specify a specific MAC address or MAC address list*
auth	*configuration mode to configure the 802.1x parameters*
auth <enable|disable>	*enables or disables the 802.1x authenticator function on MNS-6K switch*
authorize <module> key=<security key>	*activate the S-Ring or MNS-6K-SECURE capabilities. Don't forget to use the "save" command to save the key*
authserver [ip=<ip-addr>] [udp=<num>] [secret=<string>]	*define the RADIUS server*
authtraps <enable|disable>	*enables or disables authentication traps generation*
backend port=<num|list|range> supptimeout=<1-240>] [servertimeout=<1-240>] [maxreq=<1-10>]	*configure parameters for EAP over RADIUS*
backpressure rxthreshold=<value>	*configure backpressure buffers*
broadcast-protect <enable|disable>	*protect switch from broadcast storms*
chlevel user=<name> level=<number>	*changing the user privilege level*

Command	Description
clear <history|log [1..5 |informational |activity |critical |fatal |debug] |terminal |arp|portstats|addr]	*clear command to clear various aspects of the MNS-6K information – most notably "clear addr" – clears the addresses learnt or "clear log" to clear the logs (and the type of logs)*
clear log [fatal |alert| crit|error| warn| note|info|debug]	*clear logs or specific type of logs*
clear-reserveip ip=<ip>	*clear the reverse IP assigned*
climode <script|console|show>	*set the interactive CLI mode on (console) or off (script). To see the mode – use the show option*
com2sec <add|delete> id=<id> [secname=<name>] [source=<source>] [community=<community>]	*a part of the View based Access control model (VACM) as defined in RFC 2275. This specifies the mapping from a source/community pair to a security name. On MNS-6K, up to 10 entries can be specified*
command *<Enter>*	*options for a command*
community [write=<write community>] [read=<read community>] [trap=<trap community>]	*set the necessary community strings*
config startip=<start ip> endip=<endip> mask=<mask> [dns=< dns1, dns2,..dns10>] [gateway=<gateway>] [leasetime=<lease time(1..10 hours)>]	*configure the DHCP lease request parameters such as starting IP address, ending IP address, DNS server parameters, default gateway IP address and lease time*
configure access	*sets the access parameters e.g. disable telnet session*
cost port=<number|list|range> value=<0-65535>	*cost is specific to a port and the port(s) have to be specified*
configure port-security	*sets the port authorization based on MAC addresses*
configure vlan type=port	*enter the VLAN configuration commands*
cost port=<number|list|range> value=<0-65535>	*cost is specific to a port and the port(s) have to be specified*
deftrap community=<string>	*defines the default community string to be used when sending traps. When user does not specify the trap community name when setting a trap station using the "trap" command, the default trap community name is used*

Command	Description
del event=<event-id|list|range|all>	*disables alarm action in response to the specified event ID*
del port=<number|list|range>	*delete specified ports from the LACP membership. Requires the lacp module.*
delete id=<1-5>	*delete the specific id specified. The deleted id no longer receives the traps via email. The id is added using the "add" command*
delete user=<name>	*deleting a user*
deny ip=<ipaddress> mask=<netmask> service=<name|list>	*deny specific IP address or range of IP addresses*
device	*configure device and port specific settings*
dhcpsrv <start|stop>	*start or stop the DHCP server. By default, the server is off*
dualhome	*enter the dual-homing configuration sub-system*
dualhome <enable|disable>	*enable or disable dual-homing*
dualhome add port1=<port#> port2=<port#> ***OR*** **dualhome add primary=<port#> secondary=<port#>**	*dual-homing setup similar to that of unmanaged switches such as ESD42* *dual-homing setup as primary-secondary mode*
dualhome del	*Delete the dual-homing setup*
edit id=<vlan id> [name=<vlan name>] port=<number|list|range> [<mgt|nomgt>]	*edit existing VLAN name*
edit port=<number|list|range> [priority=<priority>]	*edit the membership of the ports specified for LACP ports. The priority can be from 0 – 6553. Requires LACP module.*

Command	Description
enable <user-name>	*changing the privilege level*
engineid string=<string>	*Every agent has to have an engineID (name) to be able to respond to SNMPv3 messages. The default engine ID value is "6K_v3Engine". This command allows the user to change the engine ID*
event def-owner=<string> def-comm=<string>	*define the RMON event group and the community string associated with the group*
exportlog mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>] [doctype=<raw|html>]	*facilitates the export of the event log information as a text file or as an HTML file*
flowcontrol xonlimit=<value> xofflimit=<value>	*configure flow control buffers*
forceversion <stp|rstp>	*set the STP or RSTP compatibility mode*
ftp <get|put|list|del> [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>] [user=<user>] [pass=<password>] – ***where*** **<get|put|list|del>** - different ftp operations **[type=<app|config|oldconf|script|hosts|log>]** – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch **[host=<hostname>] [ip=<ipaddress>] [file=<filename>] [user=<user>] [pass=<password>]** – parameters associated with ftp server for proper communications with the server	*upload and download information using ftp command. The IP address can be a IPv4 address or an IPv6 address*

Command	Description
group <add|delete> id=<id> [groupname=<name>] [model=<v1|v2c|usm>] [com2secid=<com2sec-id>]	*a part of the View based Access control model (VACM) as defined in RFC 2275. This command defines the mapping from sec model or a sec name to a group. A sec model is one of v1, v2c, or usm. On MNS-6K, up to 10 entries can be specified*
group add ip=<group ip> port=<number|list|range> vlan=<vlanid> **group del ip=<group ip>**	*add ports to a specific IGMP broadcast. This commands is part of the IGMP commands* *delete ports from a specific IGMP broadcast group*
gvrp <enable|disable>	*enable or disable GVRP*
host <add|edit|del> name=<host-name> [ip=<ipaddress>] [user=<user>] [pass=<password>]	*create a host entry for accessing host. This is equivalent to creating a host table on many systems. Maximum of 10 such entries are allowed*
help *<command string>*	*help for a specific command*
history def-owner=<string> def-comm=<string>	*define the RMON history group and the community string associated with the group*
igmp	*IGMP configuration mode*
igmp <enable/disable>	*enable or disable IGMP on the switch*
ipconfig [ip=<ip-address>] [mask=<subnet-mask>] [dgw=<gateway>]	*to set IP address on the switch*
kill config [save=system]	*resets the system configuration. The module_name option does not reset the specific module parameters. The modules are system, event, port, bridge, stp, ps, mirror, sntp, vlan, gvrp and snmp*
kill session id=<session>	*terminate a telnet session. See also "show session"*
lacp	*enable the LACP configuration module within CLI*
lacp <enable | disable>	*enable or disable LACP*
learn port=<number-list> <enable|disable>	*learn MAC addresses connected to the Magnum 6K switch*

Command	Description
lll <enable|disable>	*enable or disable LLL on the switch*
lll add port=<port|list|range>	*enable LLL on the list of specified ports*
lll del port=<port|list|range>	*disable LLL on the list of specified ports*
loadconf mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>]	*loading the previously saved configuration from the network using tftp, ftp or serial protocols*
logout	*logout from the CLI session*
mcast <enable | disable>	*enable or disable unknown multicast streams. The default is enabled*
mgrip <add|delete> ip=<IPaddress>	*adds or deletes a management station, specified by the IP address, which can query SNMP variables from the switch. This is done to protect the switch from being polled by unauthorized managers. Applicable for SNM v1 only. Maximum of five stations allowed.*
mode <l2|normal>	*Set the IGMP mode to be IGMP-L2 mode or normal IGMP mode*
more <enable|disable|show>	*enable or disable the scrolling of lines one page at a time*
passwd user=<name>	*changing a password for a user*
period time=<1..10>	*sets the duration of relay action for the momentary type signal. This may be needed to adjust to the behavior of the circuit or relay. Default is 3 seconds. Time is in seconds*
ping <ipaddress> [count=<1-999>] [timeout=<1-256>]	*use the ping command to test connectivity*
ping6 <ipv6-address>	*ping an IPv6 station*
port port=<number|list|range> [status=<enable|disable>] [migration=<enable>] [edge=<enable|disable>] [p2p=<on|off|auto>]	*set the port type for RSTP*
port port=<number|list|range> status=<enable|disable>	*specific ports may not need to participate in STP process. These ports typically would be end-stations. If you are not sure - let MNS-6K software make the decisions*
portaccess port=<num|list|range> [quiet=<0-65535>] [maxreauth=<0-10>] [transmit=<1-65535>]	*set port access parameters for authenticating PCs or supplicants*

Command	Description
port-mirror <enter>	*configure port mirror settings*
port-security	*configure port security settings*
priority [port=<number|list|range>] value=<0-255 | 0-65535>	*specifies the port or switch level priority. When a port(s) are specified the priority is associated with ports and their value is 0-255. If no ports are specified, then the switch (bridge) priority is specified and its value is 0-65535*
priority [port=<number|list|range>] value=<0-255 | 0-65535>	*specifies the port or switch level priority. When a port(s) are specified the priority is associated with ports and their value is 0-255. If no ports are specified, then the switch (bridge) priority is specified and its value is 0-65535*
prtmr <enable|disable>	*enable or disable port mirror settings*
ps <enable|disable>	*enable or disable port security*
qos	*enter the QoS configuration mode*
quickcfg	*quick setup for snmpv3 configuration. It automatically configures a default VACM (view-based access control model). This allows any manager station to access the Magnum 6K switch either via SNMP v1, v2c or v3. The community name is "public". This command is only intended for first time users and values can be changed by administrators who want more strict access*
rate-threshold port=<port|list|range> rate=<frames/sec>	*change the allowed broadcast rate threshold*
reauth port=<num|list|range> [status=<enable|disable>] [period=<10-86400>]	*set values on how the authenticator (Magnum 6K switch) does the re-authentication with the supplicant or PC*
reboot	*restart the switch same effect as physically turning off the power*
remove ip=<ipaddress> mask=<netmask>	*delete a specific IP address from the access or trusted host list*
remove mac=<all|address|list|range> port=<num|list|range>	*remove a MAC address entry*
removeall **reserve-ip ip=<ip> [mac=<mac>]**	*remove all IP addresses of trusted hosts* *reserve a specific IP address for a device*

Command	Description
rmon	*enter the RMON configuration mode to setup RMON groups and communities*
rstp	*enter the RSTP configuration mode*
rstp <enable|disable>	*enable RSTP – by default, this is disabled and has to be manually activated*
save	*save changes made to the configuration*
saveconf mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>]	*saving the configuration on the network using tftp, ftp or serial protocols*
sendmail server=<ip-addr> to=<email-addr> from=<email-addr> subject=<string> body=<string>	*customize (and also to send a test email to check SMTP settings) the email sent out by specifying the email subject field, server address, to field and the body of the text. See example fo the body of the text message later in this chapter*
server ip=<ip-addr> [port=<1-65535>] [retry=<0-3>]	*configure the global SMTP server settings*
server add host=<host|ip> [port=<port>] [event=<all|none|default|list>]	*add a syslog server. Maximum of five servers can be defined. Note use the "syslog" command to use this command*
server edit id=<id> [host=<host|ip>] [port=<port>] [event=<all|none|default|list>]	*edit the server setup as well as which syslog messages the server should receive. Note use the "syslog" command to use this command*
server del id=<id>	*delete a Syslog server. Note use the "syslog" command to use this command*
server <enable|disable> id=<id>	*enable or disable the log messages being sent to a syslog server. Note use the "syslog" command to use this command*
set bootmode type=<dhcp|bootp|manual|auto> [bootimg=<enable|disable>] [bootcfg=[<enable|disable>]	*assign the boot mode for the switch*

Command	Description
set date year=<2001-2035> month=<1-12> day=<1-31> [format=<mmddyyyy|ddmmyyyy|yyyymmdd>]	*sets the date and the format in which the date is displayed*
set daylight country=< country name>	*set the daylight saving time*
set dns [server=<ip>] [domain=<domain name>] <enable|disable|clear>	*specify a DNS server to look up domain names. The sever IP can be a IPV6 address as well as an IPV4 address*
set ftp mode=<normal|passive>	*set the ftp mode of operation*
set history size=<1..100>	*Set the history stack size – i.e. the number of commands to remember*
set igmp mode= <normal|l2>	*set the IGMP mode. Normal is when a L3 device is in the network and is the IGMP root. The IGMP-L2 is used when there is no L3 device in the network*
set logsize size=<1-1000>	*set the log buffer size*
set motd	*after the command is typed, MNS allows you to enter the Banner message*
set password	*set or change password*
set prompt <prompt string>	*set the prompt for switch. The prompt has predefined variables. These are $n : System Name; $c : System Contact; $l : System Location; $i : System IP; $m : System MAC; $v : Version; $$: $ Character; $r : New Line; $b : Space*
set secrets <hide|show>	*sets the system parameter to display or hide the passwords*
set serial [baud=<rate>] [data=<5|6|7|8>] [parity=<none|odd|even>] [stop=<1|1.5|2>] [flowctrl=<none|xonxoff>]	*set serial port parameters*
set snmp type=<v1|all>	*define the version of SNMP to use – the option all supports all versions (v1, v2 and v3) – v1 restricts SNMP to v1 only. By default – SNMP v1only is enabled*

Command	Description
set stp type=<stp|rstp>	*Set the switch to support RSTP or change it back to STP. Need to save and reboot the switch after this command*
set time hour=<0-23> min=<0-59> sec=<0-59>	*sets the time*
set timeformat format=<12|24>	*set the display time in the 12/24 hour mode*
set timezone GMT=[+ or -] hour=<0-14> min=<0-59>	*sets the timezone*
set vlan type=<tag|none>	*defines the VLAN type*
set-forbid vlan=<tag vlanid> forbid=<port-number|list|range>	*sets the forbid GVRP capability on the ports specified*
set-leave <enable|disable>	*enables or disables the switch to immediately process a host sending a leave message rather that wait for the timer to expire*
setport monitor=<monitor port number> sniffer=<sniffer port number>	*set port mirror settings*
set-port port=< port|list|range> mode=<auto|forward|block>	*set the port characteristics for IGMP. Block drops the unregistered multicasts. Forward forwards unregistered multicasts*
set-port port=<number|list|range> default id=<number>	*sets the default VLAN id. For Magnum 6K family of switches, the default VLAN id is 1, unless changed using this command*
set-port port=<number|list|range> filter status=<enable|disable>	*enables or disables the VLAN filtering function.*
set-port port=<number|list|range> join id=<number>	*adds the specified port(s) to the specified VLAN id*
set-port port=<number|list|range> leave id=<number>	*releases a specific port from a VLAN*
set-port port=<number|list|range> tagging id=<number> status=<tagged|untagged>	*defines whether the outgoing packets from a port will be tagged or untagged.*

Command	Description
setport port=<num|list|range> [status=<enable|disable>] [control=<auto|forceauth|forceunauth>] [initialize=<assert|deassert>]	*setting the port characteristic for an 802.1x network*
setport port=<port#|list|range> [name=<name>] [speed=<10|100>] [duplex=<half|full>] [auto=<enable|disable>] [flow=<enable|disable>] [bp=<enable|disable>] [status=<enable|disable>]	*configure port settings*
set-ports port=<port|list|range> state=<learn|block|disable>	*set the state of the port to learn, block or disable for GVRP. Note the default state is disable*
set prompt <prompt string> The length of the prompt is limited to 60 characters. The predefined variables are **$n** : System Name **$c** : System Contact **$l** : System Location **$i** : System IP **$m** : System MAC **$v** : Version **$$** : $ Character **$r** : New Line **$b** : Space	*Set the prompt string*

Command	Description
set-qi interval=<value>	*The IGMP querier router periodically sends general host-query messages. These messages are sent to ask for group membership information. This is sent to the all-system multicast group address, `224.0.0.1`. The default value is 125 seconds. The valid range can be from 60 to 127 seconds.*
set qos type=<port|tag|tos|none> port=<port|list|range> [priority=<high|low>] [tos=<0-63|list|range>][tag=<0-7|list|range>]	*depending on the type of QOS, the corresponding field has to be set. For example, for QOS type tag, the tag levels have to be set, and for QOS type ToS, the ToS levels have to be set. If the priority field is not set, it then defaults to low priority. ToS has 64 levels and the valid values are 0-63 and a tagged packet has 8 levels and the valid values are 0-7.*
set-qri interval=<value>	*The query response interval is the maximum amount of time that can elapse between when the querier router sends a host-query message and when it receives a response from a host. The Default value is 10 seconds. The Range can be from 2 to 270 seconds. Restrictions apply to the maximum value because of an internal calculation that is dependent on the value of the Query Interval.*
set-querier <enable|disable>	*enables or disables a switch as IGMP querier*
setsntp server = <ipaddress> timeout = <1-10> retry = <1-3>	*setup the SNTP server*

Command	Description
set-untag port=<port|list|range> priority=<high|low> tag=<0-7>	*The 802.1p user priority assigned to untagged received packets to be transmitted as tagged from the priority queue*
setvar [sysname|syscontact|syslocation]=<string>	*set the system name, contact and location information*
setvar [sysname|syscontact|syslocation]=<string>	*sets the system name, contact and location. All parameters are optional but a user must supply at least one parameter*
set-weight weight=<0-7>	*sets the port priority weight for All the ports. Once the weight is set, all the ports will be the same weight across the switch. The valid value for weight is 0-7*
stftp<get|put| list|del > [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>] Where **<get|put| list|del >** - different sftp operations – get a file from the server or put the information on the server or list files on the server or delete files from the server **[type=<app|config|oldconf|script|hosts|log>]** – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch **[host=<hostname>] [ip=<ipaddress>] [file=<filename>]** – parameters associated with tftp server for proper communications with the server	*upload and download information using sftp command*

Command	Description
show address-table	*displays which mac address is associated with which port for packet switching*
show active-stp	*status whether STP or RSTP is running*
Show active-snmp	*display the version of SNMP currently in use*
show alarm	*displays the current status of Alarm system*
show auth <config|ports>	*show the 802.1x configuration or port status*
show backpressure	*display backpressure buffers*
show config	*show setup parameters configured*
show console	*displays the console settings*
show date	*displays the date*
show dhcpsrv <config|status|leases>	*display the DHCP server configuration, leases as well as status*
show dns	*display the DNS settings*
show dualhome	*Display dual-homing status*
show flowcontrol	*display flow control buffers*
show ftp	*display the current ftp operation mode*
show gvrp	*shows whether GVRP is disabled, along with the current settings for the maximum number of VLANs and the current Primary VLAN*
show history	*show the last 25 commands executed – if less than 25 commands are executed, only those commands executed are shown*

Command	Description
show host	*display the hosts table entries*
show igmp	*IGMP operation status*
show ip-access	*display all trusted hosts*
show ipconfig	*shows the IP parameters set in the switch*
show lacp	*displays the status and other relevant LACP information*
show lll	*display the status of LLL*
show log [fatal|alert|crit|error|warn|note|info|debug]	*display logs and specific types of logs*
show motd	*displays the current message set*
show port[=<Port number>]	*display port settings*
show port-mirror	*display port mirror settings*
show port-security	*display port security settings*
show qos [type=<port|tag|tos>] [port=<port|list|range>]	*displays the QoS settings*
show rmon <stats|hist|event|alarm>	*list the specific RMON data as defined by the group type*
show serial	*displays the serial port settings*
show session	*Display the current telnet sessions. See also "kill session"*
show setup	*displays the system parameters setup on the system*
show setup	*show setup parameters*
show smtp <config|recipients>	*config – displays the current SMTP global settings and recipients displays the currently configured recipients of email alerts*

Command	Description
show snmp	*displays the SNMP configuration information*
show sntpsrv	*display the status of SNTP server*
show ssh	*display ssh setting. For displaying the telnet setting use show console*
show s-ring	*show the status of S-Ring*
show stp <config|ports >	*regardless of whether STP is enabled or disabled (default) this command lists the switch's full STP configuration, including general settings and port settings*
show stp <config|ports>	*display the RSTP or STP parameters*
show sysconfig	*displays the settable system parameters*
show syslog	*display the syslog settings*
show tacplus <status|servers>	*show status of TACACS or servers configured as TACACS+ servers*
show time	*displays the system time*
show timezone	*displays the timezone information*
show uptime	*displays the amount the time elapsed since the last reboot or power failure*
show version	*displays the version of MNS-6K being used*
show vlan type=<port|tag> [<id=vlanid>]	*display specific VLAN information*
show-authtrap **show-deftrap**	*displays the current value of authentication trap status* *displays the current value of default trap*
show-forbid	*display the ports with GVRP forbid capabilities*
show-forceversion	*the current forced version*
show-group	*shows the multicast groups*
show-group [id=<id>]	*display all or specific group entries - id is optional and is the number corresponding to the group entry number in the table*
show-port	*display the port characteristics for IGMP*
show-port [port=<port|list|range>]	*shows all parameters related to tag vlan for the list of ports. If the port parameter is omitted, it will display all ports*
show-portweight	*display the weight settings on a port*

Command	Description
show-router	*displays detected IGMP-enabled router ports*
show-stats port=<num>	*displays 802.1x related statistics*
show-timers	*show the values of the timers set for RSTP*
show-trap [id=<id#>]	*shows the configured trap stations in tabular format - id is optional and is the number corresponding to the trap entry number in the table*
show-user [id=<id>]	*display all or specific view entries - id is optional and is the number corresponding to the view entry number in the table*
show-view [id=<id>]	*display all or specific view entries - id is optional and is the number corresponding to the view entry number in the table*
show-vlan	*list all the VLANs (including dynamic VLANs) on the switch*
signal port=<num|list|range> <none|log|trap|logandtrap>	*port to monitor and signal to send in case of breach of port security*
smtp	*configure the SNMP alerts to be sent via email*
smtp <enable|disable>	*enables or disables SMTP to send SNMP alerts by email*

Command	Description
snmp	*enter the SNMP Configuration mode*
snmpv3	*enter the SNMP V3 configuration mode – note enable SNMP V3 by using the* ***"set snmp"*** *command which follows*
sntp [enable|disable]	*enable or disable the SNTP services*
sntpserver	*enter the SNTP Server configuration mode*
sntpsrv <start|stop>	*Start or stop the SNTP Services*
ssh <enable|disable|keygen>	*enable or disable the server. Also can be used for generating the key*
ssh port=<port|default>	*select a different port number for SSH communication*
s-ring <enable/disable>	*enable or disable S-ring capabilities*
s-ring add port=<port1,port2>	*define ports which make up the s-ring ports. Note as discussed earlier, you can create multiple s-rings on a switch*
s-ring del port=<port1,port2>	*remove the switch from S-ring topology by eliminating the end ports on the switch*
s-ring learn	*start the learning process to discover the ring and the ports which make up the s-ring*

Command	Description
start vlan=<name|number|list|range>	*activate the VLAN configuration*
static vlan=<VID>	*convert a dynamic VLAN to a static VLAN*
statistics def-owner=<string> def-comm=<string>	*define the RMON statistics group and the community string associated with the group*
stp	*STP Configuration mode*
stp <enable|disable>	*Start (Enable) or stop (Disable) STP*
sync [hour=<0-24>] [min=<0-59>]	*setup the frequency at which the SNTP server is queried*
syslog	*syslog context commands*
syslog <enable|enable>	*enable (or disable) the syslog messages*
tacplus <enable|disable> [order=<tac,local | local,tac>]	*enable or disable TACACS authentication, specifying the order in which the server or local database is looked up where "tac,local" implies, first the TACAS+ server, then local logins on the device*
tacserver <add|delete> id=<num> [ip=<ip-addr>] [port=<tcp-port>] [encrypt=<enable|disable>] [key=<string>] [mgrlevel=<level>] [oprlevel=<level>]	*adds a list of up to five TACACS+ servers where* **<add|delete>** – [mandatory] adds or delete a TACACS+ server. **id=<num>** – [mandatory] the order in which the TACACS+ servers should be polled for authenticaton **[ip=<ip-addr>]** – [mandatory for add] the IP address of the TACACS+ server **[port=<tcp-port>]** – [optional for add] TCP port number on which the server is listening **[encrypt=<enable|disable>]** – [optional for add] enable or disable packet encryption **[key=<string>]** – [optional for add, mandatory with encrypt] when encryption is enabled, the secret shared key string must be supplied **[mgrlevel=<level>]** and **[oprlevel=<level>]** – [optional] specifies the manager and operator level as defined on the TACACS+ server for the respective level of login
telnet <enable|disable>	*enable or disable telnet sessions*

Command	Description
telnet <ipaddress> [port=<port number>]	*telnet from the switch. The IP address can be an IPv4 address or an IPv6 address*
timers forward-delay=<4-30> hello=<1-10> age=<6-160>	*change the STP Forward Delay, Hello timer and Aging timer values*
tftp <get|put> [type=<app|config|oldconf|script|hosts|log>] [host=<hostname>] [ip=<ipaddress>] [file=<filename>] ***where*** **<get|put>** - different tftp operations – get a file from the server or put the information on the server **[type=<app|config|oldconf|script|hosts|log>]** – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configuration file or uploading a new image to the switch **[host=<hostname>] [ip=<ipaddress>] [file=<filename>]** – parameters associated with tftp server for proper communications with the server	*upload and download information using tftp command*
traps <add|delete> type=<Snmp|Rmon|Snmp,Rmon|Enterprise| Snmp,Enterprise|Rmon,Enterprise|All> ip=<ipaddress>	*add SNMP v1 traps as well as define the trap receiver*
trap <add|delete> id=<id> [type=<v1|v2|inform>] [host=<host-ip>] [community=<string>] [port=<1-65534>]	*define the trap and inform manager stations. The station can receive v1, v2 traps and/or inform notifications. An inform notification is an acknowledgments that a trap has been received. A user can add up to 5 stations.*
trigger-reauth port=<num|list|range>	*manually initiate a re-authentication of supplicant*

Command	Description
user <add|delete> id=<id> [username=<name>] [usertype=<readonly|readwrite>] [authpass=<pass-phrase>] [privpass=<pass-phrase>] [level=<noauth|auth|priv>] [subtree=<oid>]	*for quickly adding or deleting v3 USM based security, this command adds user entries. MNS-6K allows up to 5 users to be added. Right now, the MNS-6K agent only support noauth and auth-md5 for v3 authentication and auth-des for priv authentication*
useraccess user=<name> service=<telnet|web> <enable|disable>	*defines the services available to the user to access the device for modifying the configuration*
useraccess user=<name> group=<list> type=<read|write> <enable|disable>	*set read or write access for the command group*
useraccess groups	*displays the current groups*
view <add|delete> id=<id> [viewname=<name>] [type=<included|excluded>] [subtree=<oid>] [mask=<hex-string>]	*a part of the View based Access control model (VACM) as defined in RFC 2275. This command defines a manager or group or manager stations what it can access inside the MIB object tree. On MNS-6K, up to 10 entries can be specified*
vlan <enable | disable>	*Configure VLAN commands*
vlan	*Enter the VLAN command set*
xmodem <get|put> [type=<app|config|oldconf|script|hosts|log>] ***where*** **<get|put>** - different xmodem file transfer operations – get a file from the server or put the information on the server **[type=<app|config|oldconf|script|hosts|log>]** – optional type field. This is useful to specify whether a log file or host file is uploaded or downloaded. This can also perform the task of exporting a configurat	*upload and download information using xmodem command and console connection*
vlan type=port	*enter the VLAN configuration commands*

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APPENDIX

3

APPENDIX 3 - Daylight Savings

No time like the present...

Daylight Savings Time

Magnum6K Switches provide a way to automatically adjust the system clock for Daylight Savings Time (DST) changes. In addition to the value "none" (no time changes), there are fifteen pre-defined settings, a few examples are:

- Alaska
- Canada and Continental US
- Middle Europe and Portugal
- Southern Hemisphere
- Western Europe

The pre-defined settings follow these rules:

Alaska

- Begin DST at 2am the first Sunday on or after April 24th
- End DST at 2am the first Sunday on or after October 25th

Canada and Continental US

- Begin DST at 2am the first Sunday on or after April 1st
- End DST at 2am the first Sunday on or after October 25th

Middle Europe and Portugal

- Begin DST at 2am the first Sunday on or after March 25th
- End DST at 2am the first Sunday on or after September 24th

Southern Hemisphere

- Begin DST at 2am the first Sunday on or after October 25th
- End DST at 2am the first Sunday on or after March 1st

Western Europe:

- Begin DST at 2am the first Sunday on or after March 23rd
- End DST at 2am the first Sunday on or after October 23rd

Daylight saving time is defined for the following countries

Australia, Belgium, Canada, Chile, Cuba, Egypt, France, Finland, Germany, Greece, Iraq, Italy, London, Namibia, Portugal, Russia, Spain, Sweden, Switzerland, Syria, USA

Note – as of Release 3.7, the new daylight saving times dates enforced as of 2007, for the time zones and states in US, have been implemented in MNS-6K

APPENDIX

4

APPENDIX 4 – Browser Certificates

You shouldn't overestimate the I.Q. of crooks — NYT: Stuart A. Baker, General Counsel for the NSA

There is no security on this earth. Only opportunity. – Douglas MacArthur

Certificates

Certificates are means for authenticating the validity of sites, servers or other devices user can connect to for services. These include web servers, print servers, data services and more. Normally, users encounter the certificates when they sign on to web services.

One of the common methods of compromising the security is to create phishing sites. Phishing sites look like the real web site and extract information from a valid user which them compromises the security of the user (typically impersonating the individual to access information or money or other services faking their identity). This is commonly used to compromise security (and hence the quotes at the beginning of this appendix….)

Many devices as well as web sites, today use secure methods to communicate via the web. Once secure web communications are required, the browsers look at the certificate and match the URL information to the certificate information. If the information does not match, the browser flags the site as a compromised site.

Certificates allow a user accessing a web site to authenticate whether they are in fact on the proper web site. To do that, there are Certificate Authorities who validate the authenticity of the site and can issue a public certificate. This process usually costs money and time in validation etc.

Many devices use self signed certificates. Self signed certificates allow a vendor to insert in a "signature" to identify their device and other parameters. Many times, the user accessing the device will find that the device they are accessing and the self signed certificate do not match. The browser will typically catch that and will warn a user about accessing the site. The rest of the sections below will describe how to use the browsers with GarrettCom self signed certificates.

Using Mozilla Firefox (ver. 3.x)

Mozilla Firefox version 3.x ensures that the user validate the certificate before it allows the user to proceed to the site when the address (URL) does not match the information in the self signed certificate.

FIGURE 149 – *On finding a mismatch between the certificate and the accesses site, Mozilla Firefox pops the window. Note – the site was accessed using the IP address. Typically, sites accessed by their IP address will trigger this mismatch*

Make sure you click on the URL pointed to in the figure above.

FIGURE 150 – *Mozilla Firefox tries to warn the user again about the dangers of sites with improper certificates*

Once the "Add Exception" button is displayed, make sure you click on it.

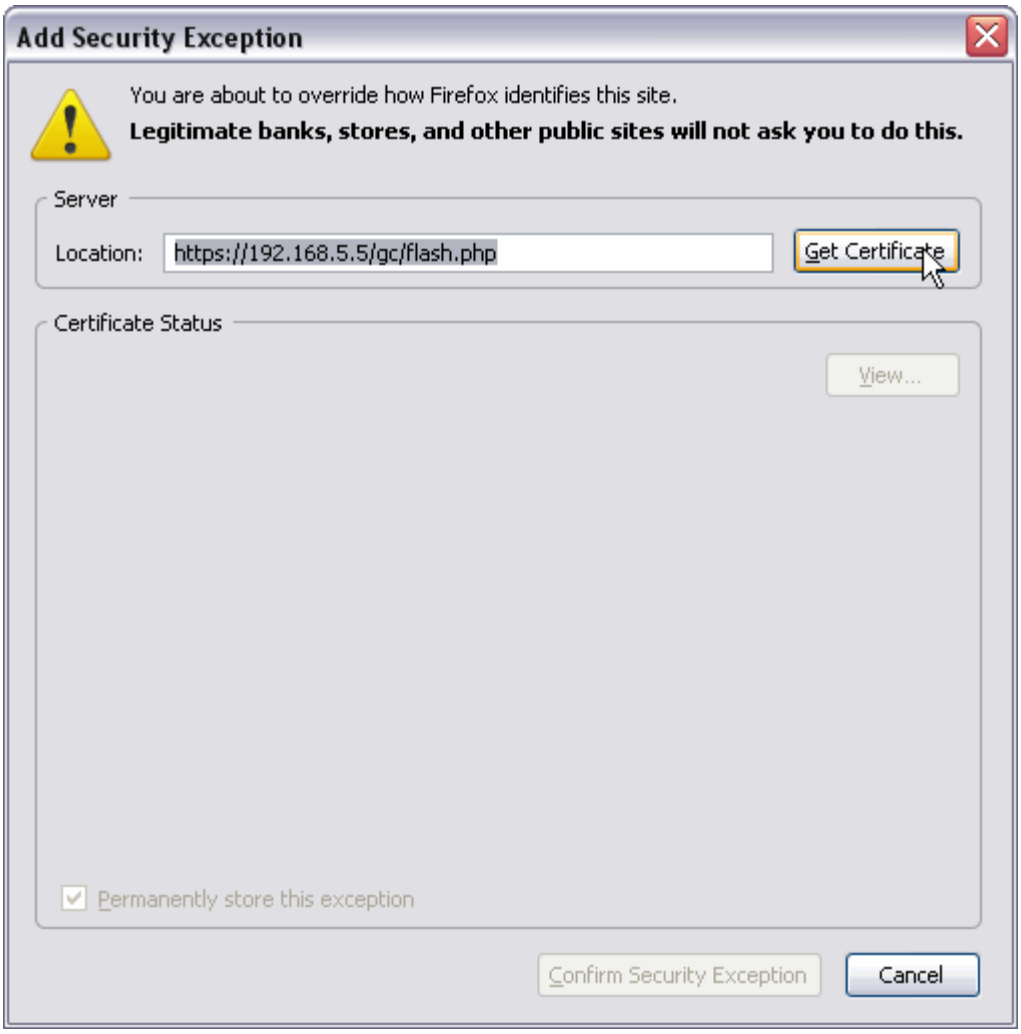

FIGURE 151 – *Firefox forces you to get the certificate before it lets you access the site*

Notice that the browser points out that valid sites such as banks, online web stores, government sites, secure sites etc. will not ask you to do that. Since the GarrettCom MNS-6K is a self signed authenticated "site", it is a good idea to proceed with this step and click on "Get Certificate" as shown above.

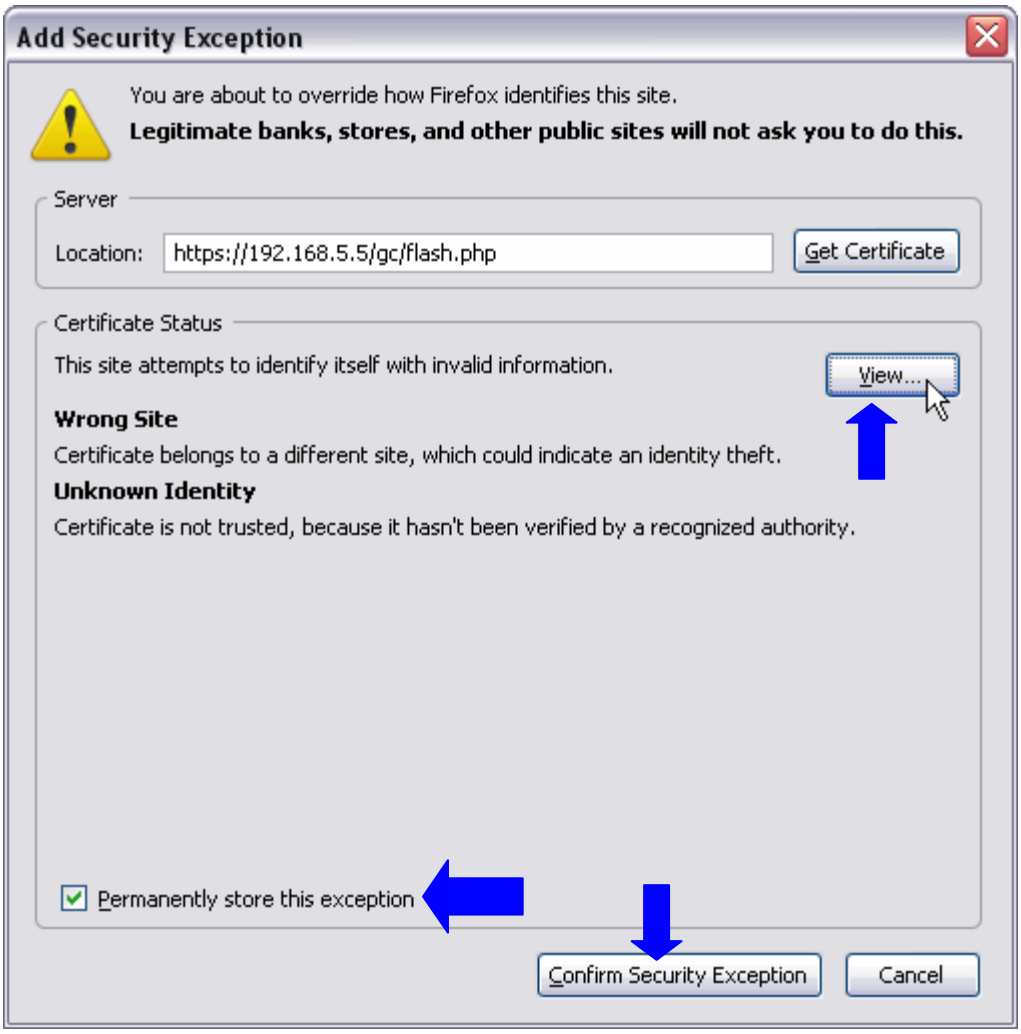

FIGURE 152 – *Here, you can view the certificate, permanently make an exception and confirm the exception. The locations to do those are identified in this figure*

The self signed certificate from GarrettCom is shown in the next figure.

FIGURE 153 – *Self signed certificate from GarrettCom Inc for MNS-6K*

Once accepted, the user does not need to go through these steps again.

Using Internet Explorer (ver 7.x)

Internet Explorer version 7.x provides a warning when the certificates do not match. There is no mechanism to create a permanent exception using IE 7.

When the exception is pointed out by IE 7, click on Continue as shown below.

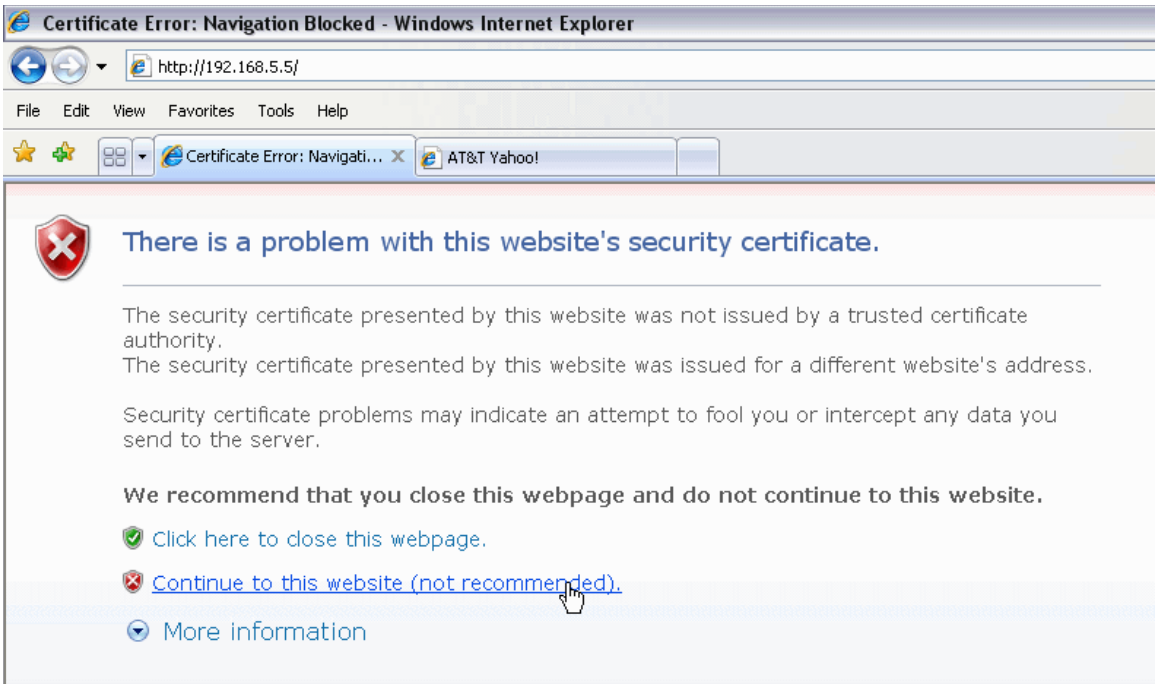

FIGURE 154 – *Using IE 7*

Using Other Browsers

There are many other browsers such as Opera, Safari which are also widely used. There are similar mechanisms built into these browsers to inspect the certificate and create an exception. Please refer to their respective documentation for help.

APPENDIX

5

APPENDIX 5 – Updating MNS-6K Software

Keep up to date....

The steps required to update the MNS-6K software on your Magnum switch are listed.

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Step 1

1. Getting Started

Decide which version to use…..

This document describes how to upgrade the MNS-6K software on a Magnum 6K switch. The methods described for updating the MNS-6K software are either locally at the console port on the Magnum 6K switch or remotely over the network using FTP or TFTP. This step involves getting ready with the necessary software and hardware tools as well as deciding on which MNS-6K software version to update to.

Depending on the update process (update through the serial/console port or remotely through the network), it would be best if the necessary tools listed below are available, tested and working before you start.

For serial port updates directly through the serial/console port

7) A female-female null modem cable. This cable is available from GarrettCom, Inc. as well as from LANstore, Inc. (http://www.lanstore.com)
8) Serial port – if your PC does not have a serial port, you may want to invest in a USB to serial converter. This is again available from LANstore or from GarrettCom. Alternately a USB to serial cable can also be used. This cable is available also available from LAN store or GarrettCom Inc.
9) A PC (or a workstation/computer) with a terminal emulation program such as HyperTerminal (included with Windows) or Teraterm-pro or other equivalent software. Make sure that the software supports Xmodem protocol
10) Enough disk space to store and retrieve the configuration files as well as copy software files from GarrettCom. We recommend that at least 15MB of disk space is available for this purpose
11) Manager level account name and password of the switch being upgraded
12) Connection to the Internet. Make sure the connection does not block ftp file transfers

For remote updates over the network

1) A PC (or a workstation/computer) with a FTP as well as TFTP server software. This software is widely available as a free download on the Internet. If you need assistance in finding one, contact GarrettCom tech support at (510) 438-9071, email – support@garrettcom.com

2) Enough disk space to store and retrieve the configuration files as well as copy software files from GarrettCom. We recommend at least 15MB of disk space for this purpose
3) Connection to the Internet. Make sure the connection does not block FTP file transfers
4) IP address of the switch that is being upgraded. Along with that, the manager level account name and password is also needed
5) Connection to the GarrettCom Magnum 6K switch. Make sure the Intranet over which the software update will occur does not block FTP or TFTP traffic.

Selecting the proper version

The first step is to ensure that you have the proper version of the MNS-6K software. To access the proper software, you will require access to the GarrettCom web site (and ftp site) through a network which does not block ftp file transfers. If your site blocks ftp file transfer traffic, please contact your system administrator to figure out how to access the GarrettCom site to download the necessary software.

First determine the version of the software on your switch. To do that, use the command 'show version' after connecting to the switch and logging in as manager, with the proper password. If the password is lost or forgotten, please contact GarrettCom Inc customer support at Phone (510) 438-9071, email – support@garrettcom.com.

The table below lists the current MNS-6K version number and software version upgrade path for the MNS-6K.

Table A4-1 – *Software upgrade matrix*

Existing software version	**Upgrade Path**	**What to do**
Version 1.0 to Version 2.5	Contact GarrettCom customer support to upgrade the software	
Version 2.5.x or higher	Latest Version of MNS-6K	Download latest version of MNS-6K from ftp://ftp.garrettcom.com/ following the steps listed below

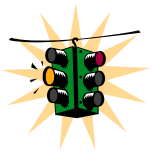
Downloading the MNS-6K software

To download the MNS-6K software, follow these simple steps:

1) Access GarrettCom's FTP site through any standard browser ftp://ftp.garrettcom.com
   a) (Note: Make sure the browser has – "enable the ftp view" option checked. For Internet Explorer it can be enabled by using the menu Tools→ Internet options → Advanced). If you are running a personal firewall or other firewall software, please ensure that ftp protocol is allowed on the computer or the network.

b) If the site uses another socket number for ftp connections, use the socket number at the end of the URL. For example, if the network administrator has setup a firewall to use socket number 1684, the URL would be as follows: ftp://ftp.garrettcom.com:1684

c) NOTE - You can use any other FTP program available on the Internet, including the 'ftp' command available on most operating systems instead of the browser for downloading the software.



Remember the file name and the directory where the MNS-6K software is stored. This will be needed later for the upgrade – irrespective of whether the MNS-6K software is updated via the serial port or over the network.

NOTE – the common error is to use ftp://www.garrettcom.com – this URL will not work. It will give you an error. Please use ftp://ftp.garrettcom.com

2) Once the connection is established, use the user login as **m6kuser** and the password as **m6kuser –** see Figure 1. If you have previously established a different login/password for the GarrettCom site, that login name and password can be used as well.

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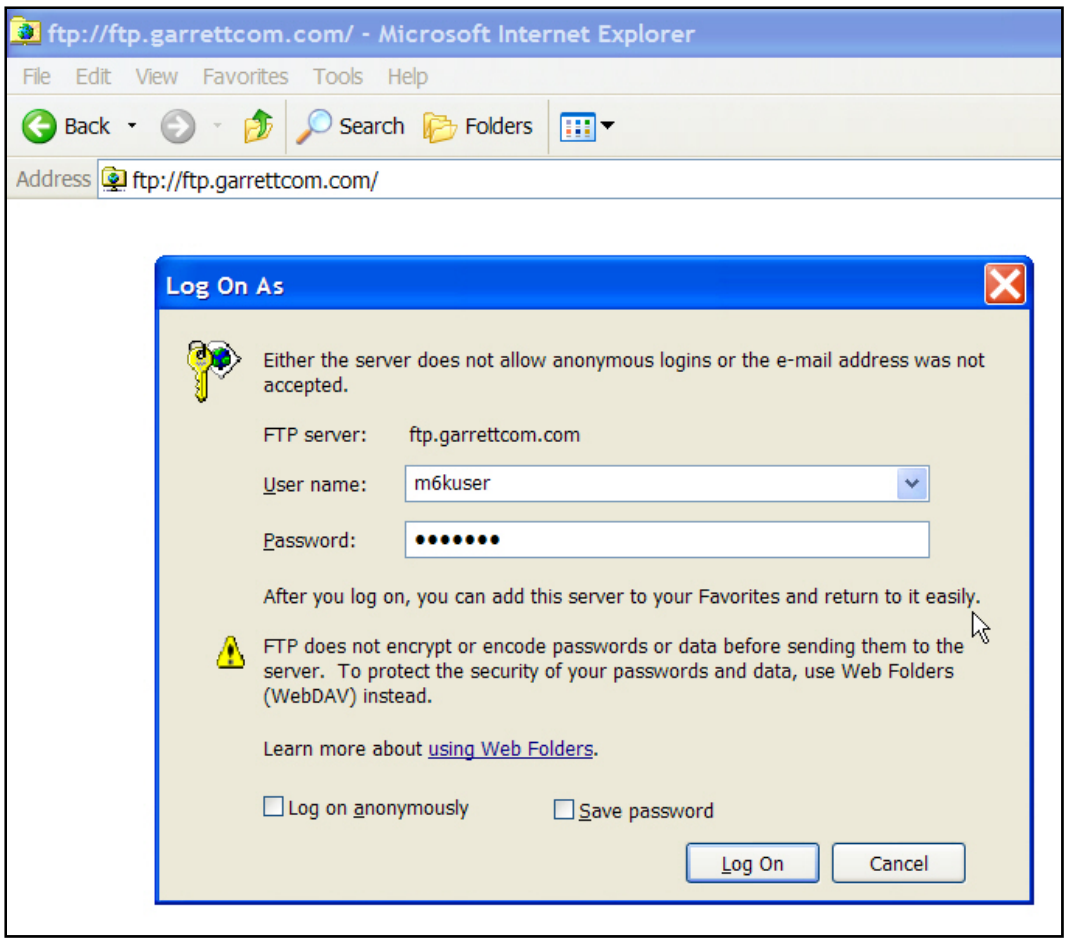


FIGURE 155 – *Accessing the GarrettCom site for download.*

Note – if the browser does not support the login prompt, you can type in the user name and password on the URL as follows:

ftp://m6kuser:m6kuser@ftp.garrettcom.com

3) After successful login, select the proper folder for downloading the proper MNS-6K software, as shown in Figure 2. Select the MNS-6K software version based on the information provided in **Table 1**.

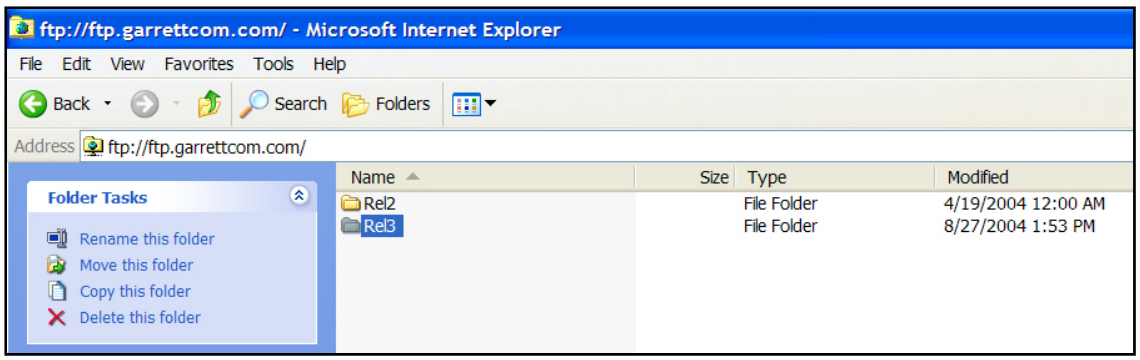


FIGURE 156 – *Select the proper version to use after successful login*

4) Navigate to the folder MNS-6K. See Figure 3. (There are other folders with additional software, MIBs as well as additional useful information for the Magnum-6K switches which you may want to use later.) From the MNS-6K folder download the latest 'Release Notes' as well as the file labeled Rel**x.x**.bin (where x.x would be the release number. For example for release 3.0, the file will be Rel3.0.bin). The release numbers increase with new releases, so the higher the number, the recent the release is. The release notes provide additional information on the latest features and functionality plus any other additional information not covered in the manuals.

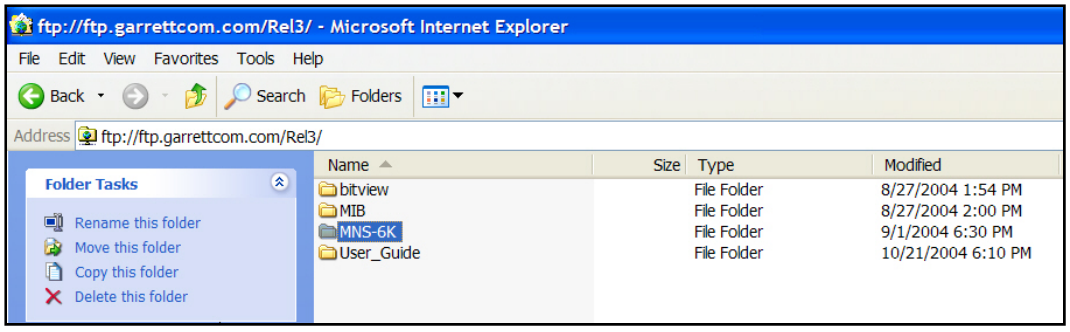


FIGURE 157 – *Navigate to MNS-6K folder to download the latest MNS-6K software and the release notes*

5) Copy the necessary files by using the copy command. This can be done by using the right click (or for left handed mouse – the left click) button and then selecting the copy command. See Figure 4. (Note - Linux or other operating system users – please use the appropriate copy command.)
   a) If you are using another ftp program, use that programs copy command. Make sure to download the **Rel.x.x.bin** file in the binary mode (especially if you are using a command line ftp command), or the MNS-6K image may be corrupted.

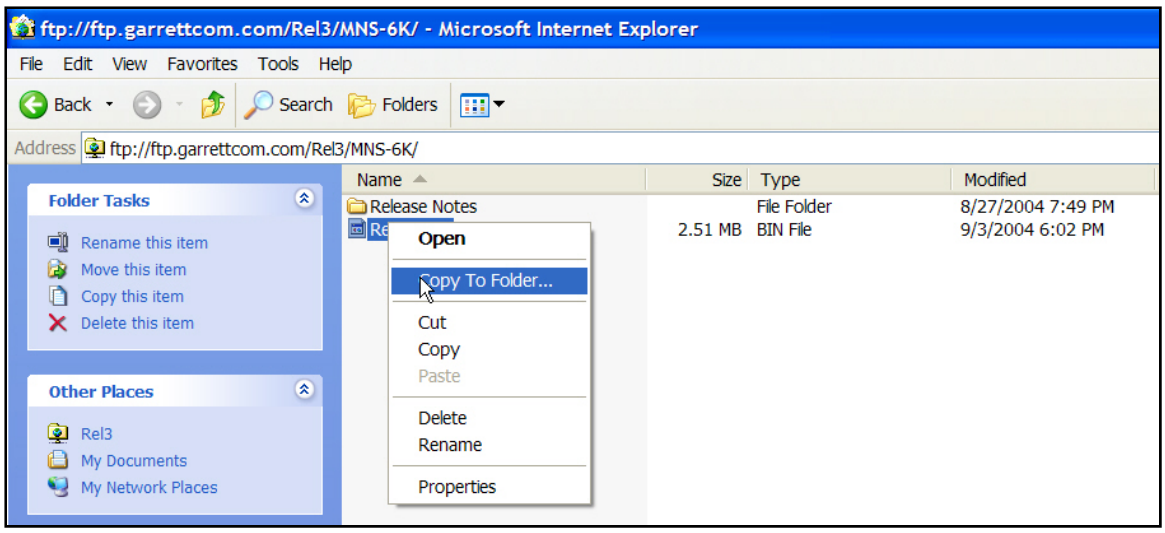


FIGURE 158 – *Use the copy command to copy the files to the proper location*

6) Make sure you remember where the files are stored as these files will be needed for the next step.

Next steps

1) Access the GarrettCom Magnum 6K switch. The access can be over the console port using the null modem cable or through the network using telnet. This is described in step 2.
2) Save the existing configuration (either through the serial port or through the network – depending on the access method). This is also described in step 2.
3) Load the updated MNS-6K software and reboot the switch. This is described in step 3.
4) (Optional step) Reload the saved configuration. This is described in step 4.

Step 2

2. Preparing to load the software

Backup your existing configuration…..

Once the MNS-6K software is downloaded from the GarrettCom site, it is strongly recommended that the existing configuration of the switch is preserved before the MNS-6K software upgrade is performed. This section will show you how to save the existing configuration and prepare you for loading the configuration.

Accessing the switch

The MNS-6K User Guide explains how the switch can be accessed. For clarity, this section simplifies the details and describes some of the commands you can use for accessing the switch.

The Magnum 6K switch can be accessed via the serial port or through the network using telnet. For using telnet, make sure the switch is configured with the proper IP address, netmask and default gateway information. If needed, refer to Chapter 1 of the User Guide on how to set IP address and related parameters on the Magnum 6K switch.

Make sure the Manager level login name and password associated with that switch is also known. Without the proper access (login name and password) the switch cannot be upgraded.

Serial Connection

Connect the serial port on the switch to the serial port on the computer using the serial cable listed in step 1. The settings for the HyperTerminal software emulating a VT100 are shown in Figure 5 below. Make sure the serial parameters are set as shown (or bps = 38400, data bits=8, parity=none, stop bits=1, flow control=none).

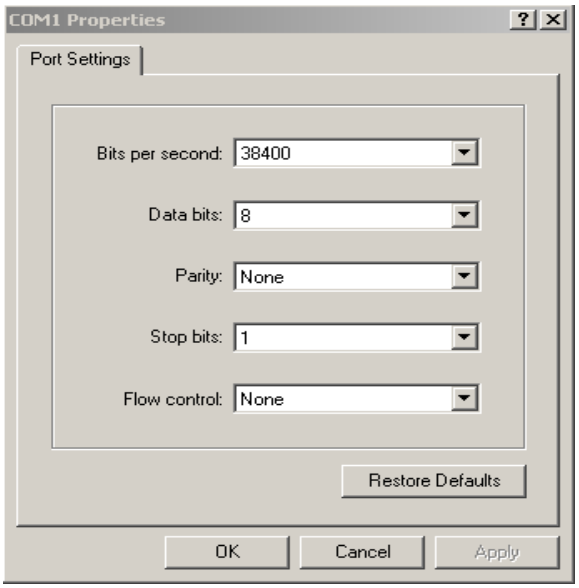


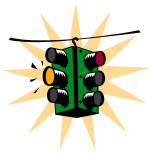
FIGURE 159 - *HyperTerminal screen showing the serial settings*

Network Access

Prerequisites - a PC (or workstation/computer) with telnet software and the IP address of the Magnum 6K switch (or DNS name associated with the switch) to be upgraded. Access the Magnum 6K switch by using the telnet command. For example, if the switch has the IP address 192.168.10.11 the command is as shown in Figure 6 below.

```
C:> telnet 192.168.10.11
Trying …..  connected…
```

FIGURE 160 – *Using telnet command to connect to a Magnum 6K switch with IP address 192.168.10.11*



If the telnet command does not work – check for network connectivity (using the 'ping' command). Please ensure that a personal firewall or other firewall settings are not affecting ping or telnet commands. If telnet services fail[10] then the alternative is to locate the Magnum 6K switch and update the MNS-6K software through the serial port following the serial update process described in this document.

Saving the Configuration

Before saving the configuration, please ensure that one of the three capabilities listed below are available

[10] telnet services can fail due to a number of reasons. Please check with your system and/or network administrator for additional help.

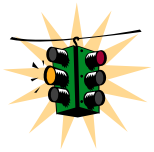
1) Serial file transfer capability such as X-modem or equivalent
2) TFTP server
3) FTP server

As a good practice, GarrettCom recommends that you should have all these capabilities available on your local computer if you plan to upgrade additional switches as well as switches in the future.

The command used for saving the existing configuration of the Magnum 6K switch is **'saveconf'**

Syntax **saveconf mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>]**
Where the [ipaddress] is the IP Address of the server running the TFTP services or the FTP services. The field is needed if either the TFTP or FTP is the mode chosen.

File=<name> is needed for saving the configuration



If mode=<tftp|ftp> is used, be aware that most FTP and TFTP services, as a default, do not over-write files. If the file transfer fails, check to see if the file name already exists or use a different file name with the **'saveconf'** command. Also make sure the ftp or TFTP/FTP services are running before the **'saveconf'** command is used on the switch.

Serial Connection

To save the configuration using the serial connection, use the **'saveconf'** command as shown below. In this example, we will show the '**saveconf'** interaction using the Hyper-Terminal software available on most Windows® systems.

```
Magnum6K25# saveconf mode=serial file=6kconfig-10.11

 Do you wish to upload the configuration? [ 'Y' or 'N'] Y

  (Use XMODEM to download configuration file)
```

FIGURE 161 – *Example of saveconf command using serial interface*

At this point, switch to the VT100 emulation software (e.g. HyperTerminal on Windows platform) and invoke the Xmodem file receive. Figure 8 shows the Xmodem process for HyperTerminal application.

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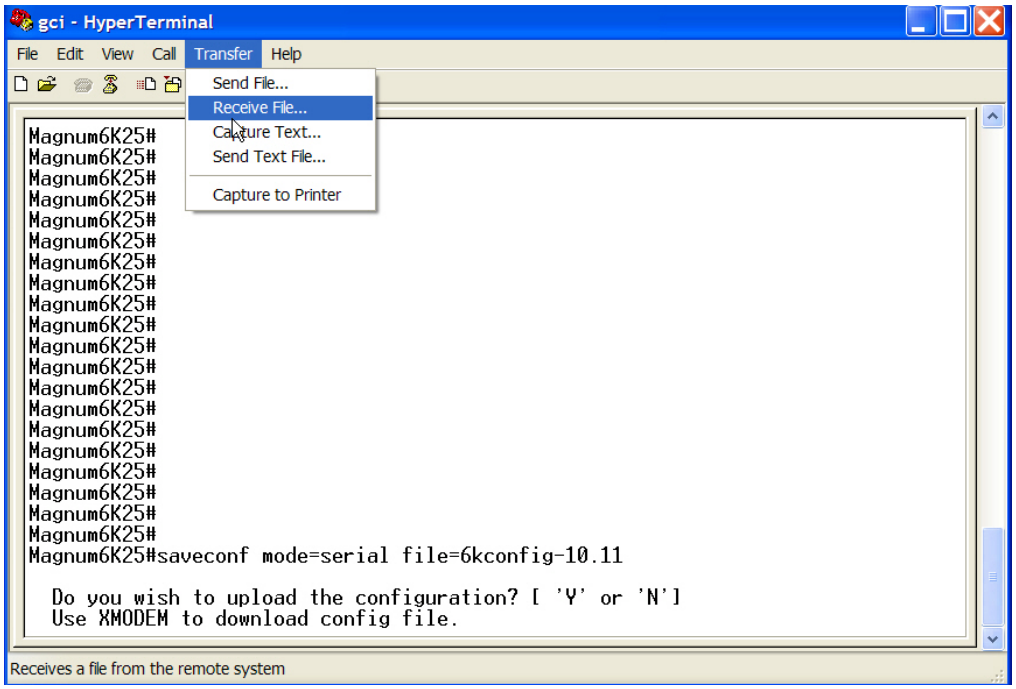


FIGURE 162 – *Invoke the "Receive File" to start the Xmodem transfer program. In the figure above the Windows XP based HyperTerminal screen is shown*

Once the "Receive File" is invoked (as shown in Figure above) follow the dialog to save the file in the proper directory with the proper name as shown in Figure below.

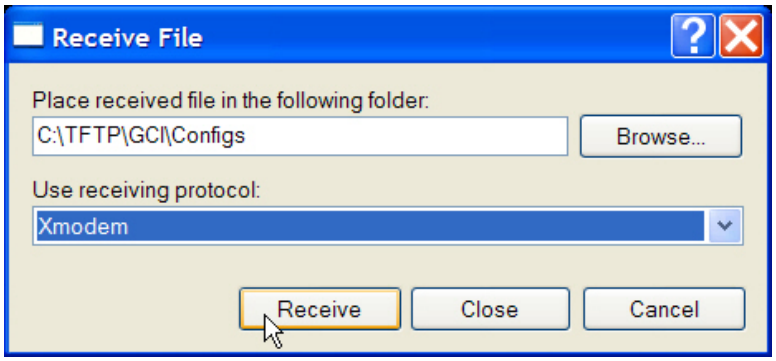


FIGURE 163 – *Make sure to select the Xmodem protocol and the proper directory where the configuration is saved. Click on Receive. This starts the file transfer.*

Once the file transfer is started, the Xmodem status window is shown in Figure 10.

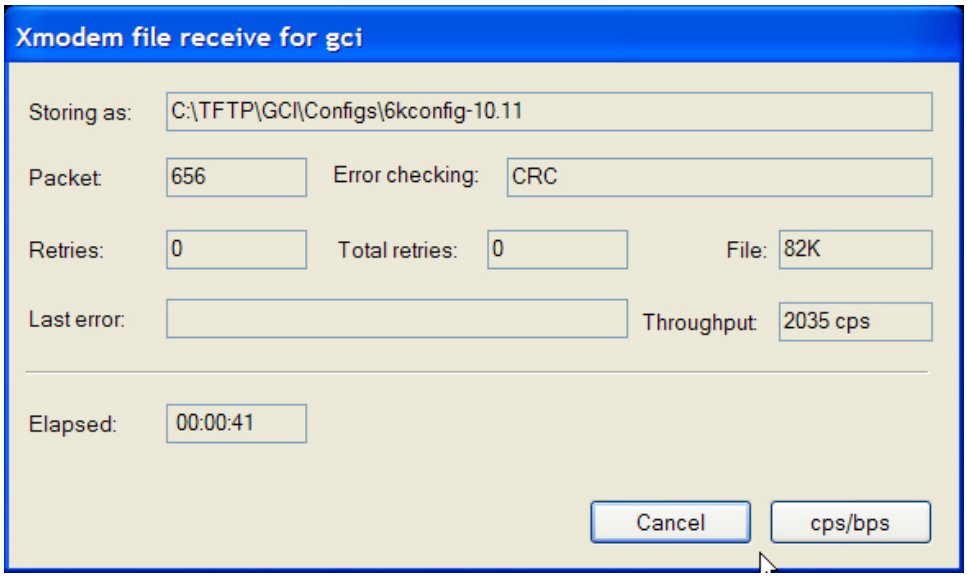


FIGURE 164 – *Status window for Xmodem (using HyperTerminal under Windows XP)*

When the file transfer is completed, the window shown in Figure 10 exits and the completion message is displayed as shown in Figure 11.

```
Successfully uploaded the configuration
Magnum6K25#
```

FIGURE 165 – *Message which shows the completion of the file transfer (from 'saveconf' command)*

Network Access

Prerequisites – PC (or workstation/computer) with telnet software and a PC (or workstation/computer) with FTP or TFTP server software. For simplicity, the two PC's (or workstations/computers) can be one and the same.

To save using TFTP or FTP first ensure that you have the FTP or TFTP server set up and the switch can 'ping' the TFTP or the FTP server. For ftp services, make sure the server can support anonymous login or make sure the login password information is available.

For saving the configuration, use the same saveconf command listed above. In the example below, assume the IP address of the TFTP or FTP server is 192.168.10.99 and is connected to the switch with proper network connectivity (i.e. the switch can ping the TFTP or FTP server as well.)

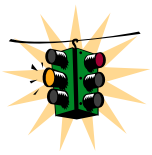
Example using TFTP

```
Magnum6K25# saveconf mode=tftp 192.168.10.99 file=6kconfig-10.11
  Do you wish to upload the configuration? [ 'Y' or 'N'] Y
```

FIGURE 166 – *Example of saveconf command for tftp*

This will save the file 6kconfig-10.11 to the specified IP address (192.168.10.99) in the default TFTP folder.

Using FTP would be the same as Figure 12, except replace **'mode=tftp'** with **'mode=ftp'**



In some situations (e.g. routed networks), TFTP or FTP services may be blocked. Check for network connectivity (using the 'ping' command). If the connectivity is OK, please contact your system or network administrator to unblock FTP or TFTP packets. If that is not possible, the alternative then is to locate the Magnum 6K switch and update the MNS-6K software through the serial port as described in this document.

Next steps

1) Upload the updated MNS-6K software and reboot the switch. This is described in step 3.
2) (Optional step) Reload the saved configuration. This is described in step 4.

Step

3

3. Loading the MNS-6K software

Load the new version of the MNS-6K image…..

AT this stage, the Magnum MNS-6K software has been downloaded from the GarrettCom site, and the configuration saved. The Magnum-6K switch is now ready to upload the new MNS-6K software image.

Before loading the MNS-6K software

It will be necessary for the Magnum 6K switch to be reset or re-booted after the new MNS-6K software is loaded. Since this may cause a network outage, software upgrades should be performed when it is tolerable for the outage and the appropriate users are informed of this outage.

Alternately, if the S-Ring technology is used, the outage will not be noticeable and the switch will be re-inserted in the S-Ring after the upgrade is performed. It is however a good practice to inform the affected people of a possible outage.

Accessing the switch

Continue to use the access method defined in steps 1 and 2.

The command used for upgrade is

Syntax **upgrade mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>]**

Where

mode is the mode by which the software will be accessed for upload – serial, ftp or tftp

ipaddress is the IP address of the ftp or tftp server (only used when mode = ftp or tftp)

file=name is the name of the MNS-6K software file to be used for upgrade. This file was downloaded from the GarrettCom site (as described in steps 1 and 2).

Serial Connection

Prerequisites - make sure the directory and the file name of the MNS-6K software image downloaded in steps 1 and 2 is known. To use the serial connection to update the MNS-6K image, the command dialog is shown below:

```
Magnum6K25# show version
 MNS-6K-Secure Ver: 14.1 Date:Jul 28 2008 Time:07:51:45 Build ID 1217245902
Magnum6K25# upgrade mode=serial
 Do you wish to upgrade the image? [ 'Y' or 'N'] Y
```

FIGURE 167 – *Upgrade using serial connection*

Once the upgrade process is started, the VT100 emulation software (e.g. HyperTerminal) will ask for the file location. Once the file location is indicated, the file transfer begins. Make sure the Xmodem protocol is also selected in this file location dialog window. Once selected, the file transfer begins. The file transfer status window is shown in Figure below. Note – Xmodem has to be set to set to **send** the file.

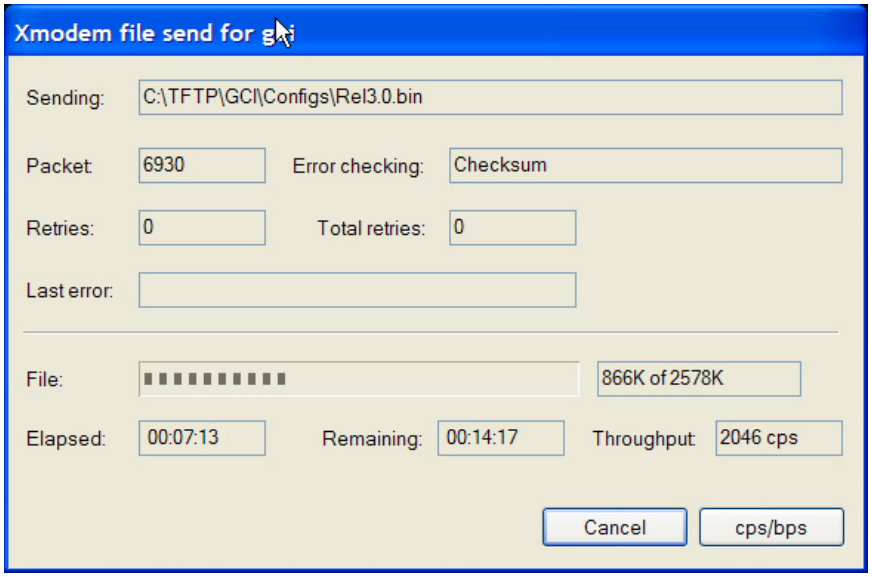


FIGURE 168 – *File upload status window under Xmodem (using HyperTerminal under Windows XP)*

Once the transfer is complete, the dialog is shown in Figure 15.

```
Upgrade is Successful.  Please reboot Magnum 6Kxx to start the application

Magnum6K25# reboot

  Proceed on rebooting the switch? [ 'Y' or 'N' ] Y

  Do you wish to save current configuration? [ 'Y' or 'N' ] Y


(The switch will now reboot. After the reboot, the Magnum 6K switch may prompt you should the
boot code need an update. If prompted, say "Y" to update the boot code. After the reboot and
login verify the MNS-6K software was upgraded.)


Magnum6K25# show version

  MNS-6K-Secure Ver: 14.1 Date:Jul 28 2008 Time:07:51:45 Build ID 1217245902
```

FIGURE 169 – *upgrading the switch using the serial interface*

Network Access

Prerequisites - make sure the directory and the file name of the MNS-6K software image downloaded in steps 1 and 2 is known. To upgrade using TFTP or FTP, ensure that the FTP or TFTP server is set up and the switch can 'ping' the TFTP or the FTP server and vice-versa. Ensure that the server has access to the MNS-6K software image downloaded in step 2. Make sure the MNS-6K software image file is copied to the default folder specified by the FTP or TFTP server. If using FTP services, make sure the FTP access information (login name and password) is also known.

In the example below, let us assume that the IP address of the TFTP server is 192.168.10.99; that the server can ping the switch and the switch can ping the server.

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```
Magnum6K25# show version
 MNS-6K-Secure Ver: 14.1 Date:Jul 28 2008 Time:07:51:45 Build ID 1217245902
Magnum6K25# upgrade mode=tftp   192.168.10.99   file=Rel4.2.bin
 Do you wish to upgrade the image? [ 'Y' or 'N'] Y
 Upgrade is Successful.  Please reboot Magnum 6Kxx to start the application
Magnum6K25# reboot
  Proceed on rebooting the switch? [ 'Y' or 'N' ] Y
  Do you wish to save current configuration? [ 'Y' or 'N' ] Y
(The switch will now reboot. Reconnect and login. Verify the MNS-6K software was upgraded.
Note – as discussed in step 1, the switch may need a boot code update. After a reboot, the switch
awaits a "Y" or "N" on whether the boot code should be updated. If no answer is given, the default
is not to update the boot code (or a "N"). Since this connection is over the network the question will
not be visible and the boot code will not be automatically updated. See step 4 – updating boot code
over the network on how to update the boot code manually.)
Magnum6K25# show version
 MNS-6K-Secure Ver: 14.1 Date:Jul 28 2008 Time:07:51:45 Build ID 1217245902
```

FIGURE 170 – *Dialog for upgrading the image using tftp*

This will load the Rel3.0.bin file from the TFTP server with the IP address (192.168.10.99) on the switch.

A similar example using ftp would be similar to what is shown in Figure 16, except the command **'mode=tftp'** will be replaced by **'mode=ftp'.** Make sure the username and password for the ftp user is known. If not known, use the user name anonymous with any password. Enter the username and password when prompted by the ftp server. Note – if you are using MNS-6K version3.0 or lower, it is best to use the FTP server without a password – i.e. use the anonymous login.

Next steps

(Optional step) Reload the saved configuration. Update the boot code if needed. This is described in step 4.

Step 4

4. (Optional Step) Restoring the configuration

Optionally, restore back the original configuration and update the boot code…..

At this optional step, the original configuration has been saved, MNS-6K image copied from the www.garrettcom.com site and then onto the Magnum 6K switch and finally, if required, the configuration can be restored using the instructions in this step. If the Magnum 6K switch is updated over the network, it maybe necessary to update the boot code.

Accessing the switch

Continue to use the access method defined in steps 1, 2 and 3.

Reloading the configuration

The command used for restoring the original configuration is

Syntax **loadconf mode=<serial|tftp|ftp> [<ipaddress>] [file=<name>]**

Where

mode is the mode by which the configuration file will be accessed for upload – serial, ftp or tftp

ipaddress is the IP address of the ftp or tftp server (only used when mode = ftp or tftp)

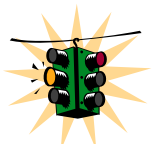
file=name is the name of the configuration file

At this stage, follow the same process for uploading the files as described in step 3. The file that needs to be uploaded is the configuration file which was saved in step 2 (as shown in Figure 7 or Figure 12.)

Updating boot code over the network

As discussed in step 1 – selecting the proper version, with either upgrade path (to Version 2.7.1B or to Version 3.0), the boot code will be updated. At boot up time, the Magnum 6K switch identifies that there is a new version of the boot code and asks if the new boot code should be loaded[11]. The new boot code is not loaded unless the user responds affirmatively to the question from the **console port** (or serial connection)[12]. If the Magnum 6K switch is upgraded over the network or remotely, the boot code can be manually updated by using the **'upgrade'** command discussed below. This allows the boot code to be updated without requiring access to serial port.

Syntax **upgrade mode=bl**



mode=bl is a hidden option and is not visible using the help capabilities in MNS-6K. This command can be executed by accessing the switch through the console port (serial connection) or through the network (telnet to the switch.)

Continue to use the network access method defined in steps 1, 2 and 3. Use the upgrade command as shown in Figure 17 and reboot the switch.

```
Magnum6K25# upgrade mode=bl

The BOOT Flash image will be replaced by the version
embedded in this application.

 Do you wish to upgrade the image? [ 'Y' or 'N'] Y
 Uncompressing image and programming flash memory.
 This will take up to a minute to complete...

 Boot loader upgrade is successful...

Magnum6K25# reboot

 Proceed on rebooting the switch? [ 'Y' or 'N' ] Y

Do you wish to save current configuration? [ 'Y' or 'N' ] Y
```

FIGURE 171 – *Updating the boot code over the network using the upgrade command. Make sure to reboot the switch after the boot loader upgrade is completed*

Make sure there is no power failure during the boot loader update. If the boot code does not load properly, please contact GarrettCom Inc technical support at (510) 438-9071, email – support@garrettcom.com

[11] This question is asked on the console port (serial connection) only.

[12] Note – If the response is not given, the switch will not load the new boot code.

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Index